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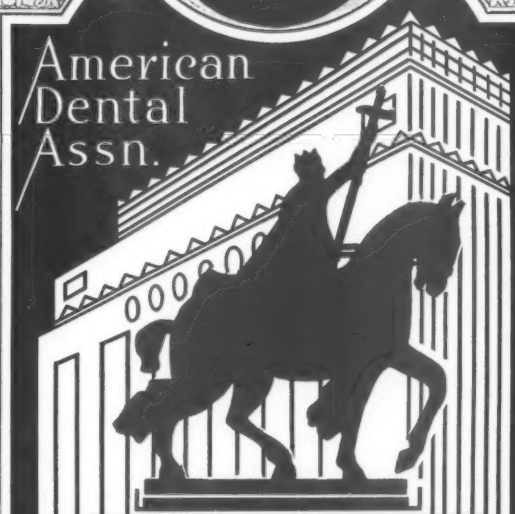

ST. LOUIS, MO.
OCT. 24-28

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The Journal of the American Dental Association and The Dental Cosmos. Vol. XXV, No. 9. Published by the American Dental Association, 212 East Superior Street, Chicago, Ill. Yearly subscription $5.00. Entered as second-class matter, March 25, 1937, at the postoffice at Chicago, Ill., under the act of Aug. 24, 1912. Published monthly.

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COMMITTEE ON LOCAL ARRANGEMENTS

Eightieth Annual Session of the American Dental Association, St. Louis, Mo., October 24-28.

UNIV. OF MICH.

THE JOURNAL *of the*
AMERICAN DENTAL ASSOCIATION*
and THE DENTAL COSMOS**

*Vol. 25, No. 9 SEPTEMBER 1938 **Vol. 80, No. 9

PROTECTION OF THE CEMENTATION OF THE THREE-QUARTER CROWN BY EFFECTIVE APPLICATION OF MECHANICS IN ITS CONSTRUCTION

By WALTER E. JONES, D.D.S., St. Paul, Minn.

IN studying the literature and analyzing the mechanics displayed in the construction of the various types of three-quarter crowns, the following conclusion has been reached: Too much attention has been given to esthetics and too little to the forces of mastication and their direction and effects, not only on the crown itself, but also on the relationship between the tooth and the crown, and on the cementation. Nor have any specific provisions been made to definitely control the effects of these forces. How can successful retention be attained without a thorough knowledge of the forces that are to be encountered? We cannot control the forces of mastication, but we can control their devastating effects on the relationship between the three-quarter crown and its supporting tooth by means of proper construction. Also, from the standpoint of the three-quarter crown, little thought has been given by the dental profession to the forces that cements are capable of resisting, forces which are detrimental to cementation.

The term cementation means the act or process of cementing; also the state of being cemented, or the result of cementing. It is the last definition that applies to the term cementation in this paper.

Cements, which are primarily intended to act as a seal and to be subjected to compressional forces only, should not be subjected to shearing stresses, rotating stresses or cleavage. In order to have successful cementation, these forces must be taken care of mechanically by the tooth and restoration, and should not be permitted to act on the cement.

We have very good cements, it is true, but it is asking too much to expect a cement to hold in place a restoration or an abutment that is poorly designed. Areas that are smooth and free from ir-

Read before the North Dakota State Dental Association, Fargo, May 18, 1937.

regularities do not lend themselves to cementation as well as do rough and irregular ones. Irregularities, such as corners, at or near the periphery of the areas to be cemented (Fig. 1, A) are more effective than irregularities elsewhere (Fig. 1, B) since they cause the forces that have a tendency to wash out the cement to change their direction, thereby making them less effective. Therefore, it is very desirable to have definite irregularities such as corners just within the periphery of the three-quarter crown. The same principle is used in metal weather-stripping.

In the literature, there has been no mention of the different stresses that the three-quarter crown has to withstand except those generally termed "the forces of mastication." Heretofore, the physics of the forces of mastication, as it applies to the three-quarter crown, has not been recognized, or it has been ignored in the construction of the various other types of three-quarter crowns. There has been nothing said about the several forces, their direction and their effects, or how and why they should be controlled; nor do these preparations show any intelligent application of the fundamental principles of mechanics in the control of the effect of the forces of mastication.

MECHANICS OF THE THREE-QUARTER CROWN

The mechanics involved in the three-quarter crown deals with the normal forces, shearing stresses, wedges, leverages and inclined planes, and the control of their effects.

The anterior teeth are wedge-shaped. The labial and lingual surfaces converge toward the incisal aspect, and the mesial and distal surfaces toward the lingual aspect. When the bell portion is removed, and the mesial and distal surfaces are made to slightly converge toward the incisal aspect, another very powerful wedge is formed. The more nearly parallel the surfaces of a wedge, or the more acute the angle, the more powerful the wedge. A wedge is a machine of cleavage or separation. Whether a wedge is driven into something or something is driven onto a wedge, the results are the same, cleavage. The effect of the wedging action of the tooth, if not controlled, is to subject the cement between the tooth and casting to a shearing action, and to

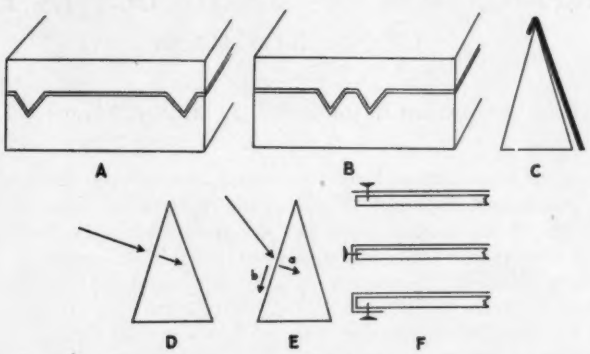

Fig. 1.—A, irregularities at periphery preventing washing out of cement more effectively than irregularities elsewhere, B. C, sheath over point of wedge to control its action. D, stress applied at right angles to surface, a normal stress. E, force applied at an angle to a surface resolving into: a, normal stress; b, shearing stress. F, application of principle of snubbing to control movement.

cause the casting to spread. The way to control the effects of a wedge is to prevent its action. This can be done by placing something over its acute angle or its functioning edge, as in Figure 1, C.

Whenever a stress (Fig. 1, D) is applied perpendicularly to a surface, it is one of pressure and is called a normal stress. When a stress (Fig. 1, E) is applied at any other angle to a surface, it immediately resolves itself into a normal stress (a) and a shearing stress (b). At the beginning of the act of incising, the stress is on the incisal edge of the anterior teeth, and is normal. Continuing the

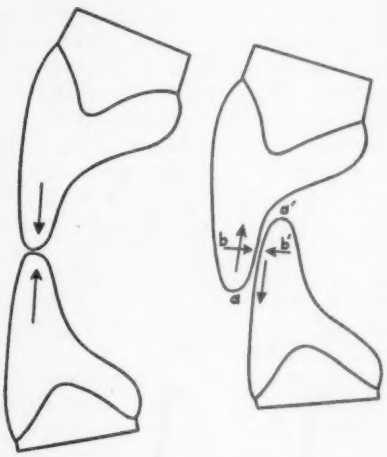

Fig. 2.—Left: Direction of stress in initial act of incising. Right: Direction of stress during remaining act of incising. a and a', shearing stresses; b and b', normal stresses.

act of incising, the stress soon changes to a shearing stress accompanied by a normal stress, passing toward the gingival aspect, labially on the lower teeth, and lingually on the upper teeth. (Fig. 2.) As soon as the posterior teeth come into occlusion, the stress on the anterior teeth is removed, there being little or no stress on the anterior teeth in the process of chewing, as there is clearance here for the lateral movements of the mandible.

On examining anterior teeth, it is found that the markings from wear are not at right angles to the long axis of the tooth, but from the incisal edge toward the gingival aspect, usually covering the incisal third of the lingual surface of the upper teeth and the incisal third or less of the labial surface of the lower teeth, and therefore giving evidence of the existence of a shearing action beginning at the incisal edge and passing toward the gingival aspect.

One of the effects of this shearing stress is to pull any material placed on the bearing surface of the tooth from the incisal edge toward the gingival aspect. When the effect of this stress is not controlled, the cement is subjected to a shearing stress which is detrimental to cementation. To control this effect, it is necessary to stop the action in its incipiency; that is, at the incisal edge. The most effective way of controlling this effect is to have the material pass over the incisal edge. As an illustration, in order to most effectively tack a covering on the top of a table, the tacks are not placed at the edge of the top, nor on the ends or sides, but underneath the table top—the application of the principle of the snub.

This shearing stress, in the case of the three-quarter crown, also causes the metal to change shape or buckle. The shearing stress and the wedging action of the tooth, when their effects are not mechanically controlled, cause the crown to change in shape, the well-known "opening at the gingival" resulting. This has been ascribed to the softness of the gold, when in reality it is due to failure to recognize the stresses that cause the condition, and the fact that the designer did not shape the tooth in such manner as to assure the proper shape of the casting to definitely control the effect of these forces. It might be mentioned here that the shape of a material has more to do with rigidity than has the hardness or bulk of that

material. This can be demonstrated in the following manner: A new dollar bill suspended lengthwise across an opening the width of the bill will not support the weight of a quarter, not even that of a dime, without sagging. Increase the thickness by suspending two bills, and they will still sag. As a matter of fact, three bills will sag under the weight of the quarter. If about a quarter of an inch of each edge of one bill is folded twice upon itself, an angle-iron effect resulting on each edge, and the bill is again suspended across the same opening, it will be found that it will support the weight of more than fifty quarters. It is amazing how much rigidity is produced by changing the shape of the bill. This is an application of the principle employed in the use of the angle-iron and the I-beam in the field of construction to produce rigidity. Why should we not use and apply the dependable and indisputable laws of physics in the construction of the three-quarter crown?

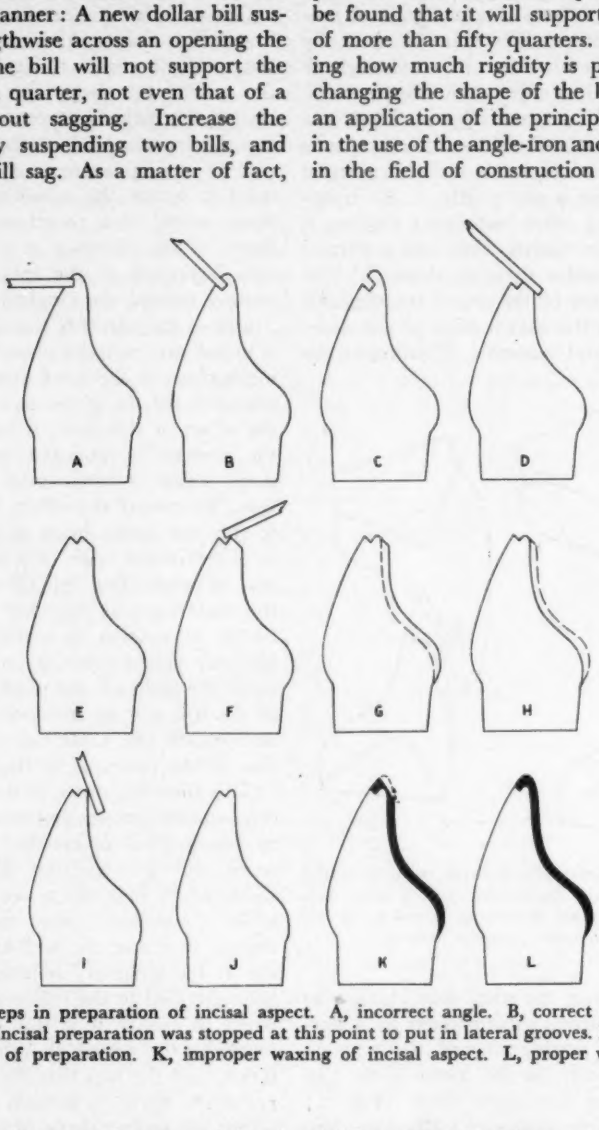

Fig. 3.—Steps in preparation of incisal aspect. A, incorrect angle. B, correct angle. C, incisal groove. Incisal preparation was stopped at this point to put in lateral grooves. D-J, finishing incisal aspect of preparation. K, improper waxing of incisal aspect. L, proper waxing of incisal aspect.

There is also a rotating force to which

the three-quarter crown, especially as an abutment, is subjected and which causes the casting to turn or rotate on the tooth. The effect of this force, when not definitely controlled, subjects the cement to a rotating stress which is detrimental to successful cementation. This can be overcome best by engaging the tooth so that the greatest diameter is within the grasp of the crown. It is for this purpose that grooves are placed on the mesial and distal surfaces of the tooth.

Angular grooves are more effective than round grooves, and small grooves in the correct position are more effective than large grooves in any other position. The incisal ends of the lateral grooves should not terminate on the lingual surface, for two reasons: (1) by so doing, they form two more wedges, the apices of which are frail pieces of tooth structure and receive the brunt of the forces of mastication, and (2) the grooves pass to the lingual side of the contact points, which as has been explained, is very undesirable.

The mechanics of three-quarter crown construction on posterior teeth is the same as that on the anterior teeth, as the stresses are the same: normal, rotating and shearing. As the two latter are the most devastating in their action on the relationship of the crown and its supporting tooth, cognizance must be taken of their effects. In the process of chewing, when the posterior teeth pass buccolingually over each other, there is a shearing stress on the bearing surface. The effect of the force from the lingual in the buccal direction is taken care of by the lingual portion of the crown. The effect of the force from the buccal in a lingual direction has its incipiency at the buccoclusal angle; therefore, it is here that it can and should be controlled. This is done by placing the retention at this point, a well-defined step. The step imparts the desired shape to the casting, giving the crown rigidity and an irregularity at its periphery. The rotating stress can be controlled by having the lateral grooves buccally to the contact points.

In order to prepare a tooth to receive a three-quarter crown and assure that this crown will withstand the effects of the forces of mastication, these forces must be recognized and analyzed. Their direction must be taken into consideration, and their effects, not only on the tooth itself, but also on the crown and on the relationship between the crown and its supporting tooth, must be thoroughly understood. Then, by application of the laws of mechanics, the tooth should be so shaped that:

1. Neither the tooth nor any part thereof is weakened by the preparation.

2. The tooth does not become a potential machine working against the casting.

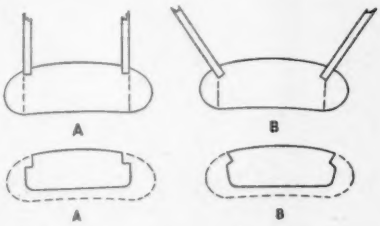

Fig. 4.—A, incorrect angle for lateral grooves. B, correct angle for lateral grooves.

3. Such shape is imparted to the crown as will enable it to resist the forces to which it is subjected.

4. When the crown is seated on the tooth, this unit will withstand the forces of mastication, so that when the crown is cemented, the cement will merely act as a seal and be subjected to compressional forces only.

TECHNIC OF PREPARATION

Models made out of proportion show a disregard for dental anatomy. Accordingly, all models pictured are made to the measurements of the average, from the "table of measurements of the teeth

of man, given in millimeters and tenths of millimeters," in Black's "Dental Anatomy." As there are no measurements given for curvatures except the curvatures of the gingival lines, the degree of other curvatures is a matter of opinion. Also an earnest effort has been made to keep all drawings and illustrations of teeth to scale.

be noted that the gingival wall of the groove follows the general direction of the enamel rods in this area. It is important to so make this cut at the proper angle as to secure maximum strength and show a minimum amount of gold. Figure 3, A shows the incorrect angle; B, the correct angle. The reason for putting the incisal groove in first is that its depth

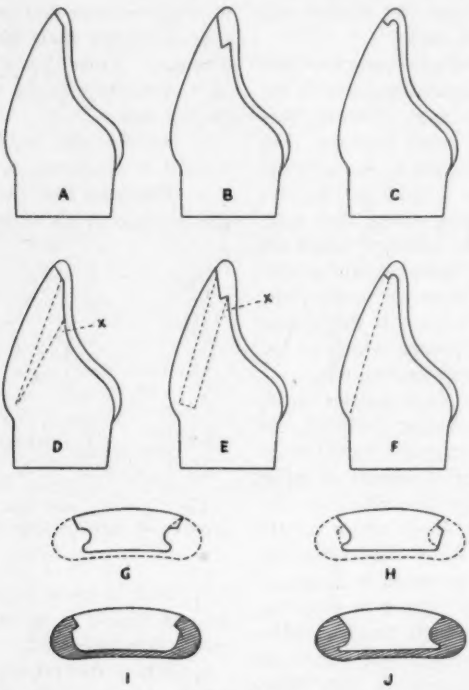

Fig. 5.—Cross-sections through median line of models and castings showing retention against shearing stress. A, no retention. B, ineffective retention. C, effective retention. D, E and F, cross-sections through models and castings at mesial surface, showing position of grooves. D and E, x, points receiving stress; cross-section through models and castings at the contact points. G and H, waste of tooth structure from use of round grooves. I, effective retention with minimum loss of tooth structure. J, ineffective retention with considerable loss of tooth structure.

1. Before any tooth structure is removed from the incisal edge, with a safe-sided carborundum disk held at a 45-degree angle to the labial surface, a groove is cut parallel to and 1 mm. from the incisal edge, to the depth of 0.5 mm. It will

becomes a guide to the depth of the incisal ends of the lateral grooves.

If difficulty is encountered in cutting this groove to the mesial and distal angles, owing to the proximity of adjacent teeth, a small knife-edge stone can be used. No

attempt should be made to put the incisal groove in after the incisal edge has been ground for clearance of the bite. It is quite difficult to hold a disk so close to the edge and cut a definite groove; furthermore, the tooth has a tendency to chip. It has been found helpful, in cutting the incisal groove, to place the thumb or forefinger on the incisal edge in such a manner as to form a rest or guide for the safe side of the disk. As large a disk as possible is used (seven-eighths inch). It has been found easier to observe the proper angle and to cut a straight groove of uniform depth with a large disk than with a small one. When the incisal groove has been made (Fig. 3, C), the lateral grooves are placed, the incisal aspect being finished later.

2. The lateral grooves are cut with a safe-sided carborundum disk held at a 45-degree angle to the labial surface. Figure 4, A illustrates the incorrect angle; B, the correct angle. The groove on the mesial aspect extends from the mesiolabiogingival angle toward the incisal aspect so that the distal edge of the groove becomes the mesiolabial angle after the bell portion is removed. The depth of the groove should be 0.5 mm. at the incisal end, or the same depth as the incisal groove, and should fade out at the gingival end. The groove on the distal aspect extends from the distolabiogingival angle toward the incisal aspect so that the mesial edge of the groove becomes the distolabial angle when the bell portion is removed.

It will be noted that the walls of the grooves are parallel to the general direction of the enamel rods, and therefore no enamel is left weakened or unsupported. These grooves are not on the labial surface, but are put in from the labial aspect on the mesial and distal surfaces, and lie just lingually to the mesiolabial or distolabial angle after the bell portion is removed. These grooves, even if the surfaces on which they are placed are parallel, will converge slightly toward the incisal aspect because they are 0.5 mm. deep at the incisal end and fade out at the gingival end. If the lateral grooves are started near the mesial or distal aspects, they can be moved medially, toward the median line of the tooth, to their proper position, care being exercised not to cut the grooves too deep. All the grooves should be started in tooth structure which will ultimately be removed, and thus there will be ample opportunity to make changes before they are placed in their final position. If, in cutting off the bell portion, it seems that the groove will be removed, it should be moved medially, not made deeper, before it is entirely obliterated, as it is rather difficult to start a new groove. It is not nec-

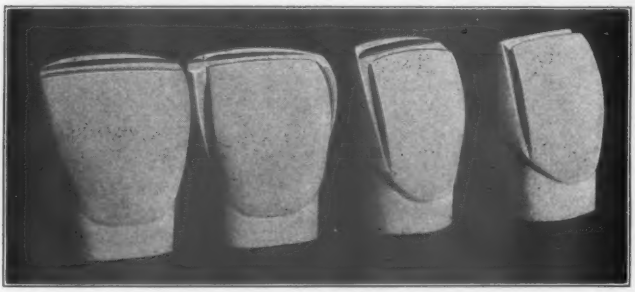

Fig. 6.—Stages of preparation.

essary to have the grooves in their final position before the bell portion is removed, because they can be moved or adjusted as the bell portion is being cut away. It is suggested that going over the grooves with a well-sharpened lead pencil will make them easier to see.

3. With a safe-sided carborundum disk, the bell portion is removed. The pushing of a toothpick or wedge between the proximal teeth at the gingival aspect will slightly separate the teeth, facilitating removal of the contact point with a safe-sided disk. The bell portion of the tooth is removed on the mesial and distal aspects, these surfaces being kept parallel or very slightly converging toward the incisal aspect. To reach and remove the bell portion from the area of the mesiolinguogingival and distolinguogingival angles, a coarse sandpaper disk that can be bent or forced to this area is used. When the bell portion is removed, a groove will lie directly lingually to the mesiolabial angle and the distolabial angle. A shoulder at the gingival border is not advocated. Its use means the removal of good tooth structure, with no mechanical advantage.

4. With a carborundum or sandpaper disk held at the same angle as for cutting the incisal groove, 0.5 mm. of tooth structure is removed from the incisal edge to allow for clearance of the bite and for the thickness of the metal. (Fig. 3, D.) When this is done, there will be left a step 0.5 by 0.5 mm. at the labio-incisal angle (Fig. 3, E), the incisal portion of which should be slightly rounded with a sandpaper disk. (Fig. 3, F.) By use of stones, enough tooth structure is removed, at least 0.5 mm., from the lingual surface to allow for clearance of the bite and for the thickness of the metal (Fig. 3, G and H) and any undercut in the area of the cingulum. To further reduce the cingulum is unnecessary. The lingual portion of the incisal edge should be rounded or slightly flattened. (Fig. 3, I.)

Care should be exercised in making the wax pattern to shape it so that the tooth is restored to its original form in this area (Fig. 3, K, incorrect; L, correct) as this area should not be cut short or thinned as is frequently done in some of the other types of preparations. If it is found necessary to remove more tooth structure from the incisal aspect than was anticipated for clearance of the bite and for the thickness of the metal, and, in so doing, it is found that the incisal step is being obliterated, the step should be moved gingivally, not cut deeper, the correct angle being kept.

The foregoing technic applies to posterior teeth as well, the retention being placed at the periphery of the prepara-

Fig. 7.—Left to right: Crown with corner removed to show mechanics of retention; inside views of casting for central incisor and bicuspid respectively; cut-out section of crown showing mechanics of retention.

tion. The buccal surface is treated as though it were a labial surface. Therefore, when sufficient tooth structure for clearance of the bite and for the thickness of the metal has been removed from the occlusal surface, a step will be formed at the buccoclusal angle. This step will be 0.5 by 0.5 mm., and the gingival portion will be parallel to the enamel rods. The lateral grooves will be cut as in the anterior teeth, the mesial groove extending from the mesiobuccogingival angle toward the occlusal aspect, and the distal groove from the distobuccogingival angle toward the occusal aspect so that they lie just lingually to the mesiobuccal and distobuccal angles after the bell portion has been removed.

Fig. 8.—Two views of grooves.

Fig. 9.—Partly prepared models showing application of mechanics. Left, ineffective. Right, effective.

THE WAX PATTERN

The wax pattern can be made by either the direct or the indirect method. It is a matter of personal preference. Those who have used the indirect method on this preparation report no difficulties. Realizing that the best model of the preparation is the tooth itself, I have always used the direct method of making the pattern; that is, the wax pattern is made on the tooth in the mouth, in the following manner:

A piece of inlay wax is warmed until it is quite pliable. With the thumb and index finger as a matrix, the wax is forced on the prepared tooth from the incisal aspect, either the finger or the thumb being kept tight on the labial surface so as to cause the wax to be forced under the free margin of the gum in the interproximal spaces, with the excess on the lingual side. The adjacent teeth act as a matrix in getting the wax into the interproximal spaces. If the adjacent teeth are missing, a matrix is formed with the fingers and thumb to adapt the wax to the tooth. In other words, the wax should be pushed onto the tooth so that it is forced under the free margin of the gum in the mesial and distal interproximal spaces with a bulk of wax on the lingual aspect. The wax is not chilled.

The wax should be rigid on the tooth and should be kept so at all times by support from a finger on the side opposite the one being worked on. Large amounts of excess wax may be removed with a sharp or warmed plastic instrument, but it is preferable to finish by scraping carefully toward the margins with a sickle-shaped explorer or scaler. With the wax supported on the labial side with the index finger, the excess wax is removed from the lingual embrasures, and cut off at the gingival margin on the lingual aspect. If the wax proves a little short at the gingival aspect, the finger or thumb that formed the matrix for that area when the wax was placed on the tooth is warmed by being passed rapidly

three or four times through the lower part of the flame of the Bunsen burner. Enough heat can be carried by the thumb or finger to the lingual surface to soften the wax so that, with a sliding motion from the incisal toward the gingival aspect, it can be forced under the free margin of the gum far enough to blanch it. It may require three or four applications of the heated finger, the wax being supported on the labial aspect during the procedure. It is possible to move the wax the distance of the gingival third with ease by this method.

When the wax is under the free margin of the gum on the lingual aspect, the remaining wax on this surface is trimmed to the desired shape and thickness, still being supported from the labial side. When the trimming or carving is completed in this area, the wax pattern is supported on the lingual surface with the thumb or finger to prevent it from moving while the excess is scraped from the labial surface.

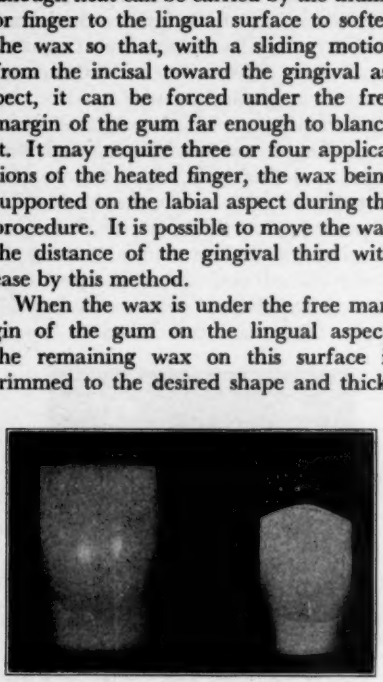

Fig. 10.—Left: Central incisor with casting. Right: Bicuspid with casting.

By trimming the wax in the embrasures of the lingual and the labial aspects, little wax is left to be removed from the interproximal spaces. If, however, it is necessary to enter this area, a ligature, flattened by being pulled tightly against the adjacent tooth, and moved linguolabially, can be passed nearly to the gum line without distorting the wax, but to go through may break the wax or dislodge the pattern. Following the path of the ligature, a fine cuttle finishing strip, with the smooth side toward the adjacent tooth, and using the same movement, can be passed to the gum line, and the excess wax can be removed by gently stripping the pattern. If this is done carefully and the strip is kept straight, not pulled around the tooth, the pattern will not be distorted. If there is no adjacent tooth, the wax can be brought to place with a warm instrument. If the wax does not go to place in the groove, it can be softened with a warm plastic instrument and pressed into place. When the carving of the wax pattern is completed, it is removed with an explorer by placing the point in the center of the lingual surface and pulling gently toward the incisal aspect. Melted wax is flowed over the hole made by the explorer point.

The following suggestions may be of help: The wax must be softened, not melted, and kept soft until it is pushed or forced to place. Cold wax cannot be manipulated. The hands must be warm, as cold fingers will chill the wax before it can be seated. The wax should not be chilled, except in very warm weather, as it becomes too brittle and is apt to break in carving. The wax or pattern should be kept rigid on the tooth and supported on one side while the operator is working on the other. The lingual aspect is finished first, then the labial. The margins are finished last.

Let us now analyze the preparation and casting to see whether those principles of mechanics have been applied which will make this unit a successful prosthesis or abutment. Let us also compare this preparation and casting to the preparation and castings of some of the other types of three-quarter crowns.

A cross-section (Fig. 5, C) through the median line of the tooth and casting shows a hooklike portion of the crown

extending over the incisal edge of the tooth. In providing for this, it will be noted that the tooth was not weakened in this area, but was so shaped that it forms a definite support for the crown, which in turn protects the incisal edge of the tooth. This hooklike portion of the crown acts as a sheath over the points of the wedges, the tooth being wedge-shaped labiolingually and mesiodistally after being prepared, which prevents the wedges from acting. If the wedges did not have a definite seat or were allowed to move, they would subject the cement to a shearing force and the walls of the crown to a cleavage action. This hook, therefore, forms a positive seat for the crown and definitely takes care of the effects of the wedges.

Cross-sections (Fig. 5, A and B) through the median line of two of the other types of three-quarter crown preparations and their castings show no definite means of controlling the effects of the wedge.

By referring again to Figure 5, C, it can be seen that the hooklike portion of this crown definitely takes care of the effect of stresses, normal or shearing, however they are applied; i.e., whether they are applied on the incisal ends of the teeth, as in the initial act of incising and in the end-to-end bite, or are applied, as the act of incising continues, on the lingual surface of the upper teeth or on the labial surface of the lower teeth, or vice versa, as in an abnormal bite. Therefore, the underlying cementation is protected against the action of shearing stresses.

In Figure 5, A and B, it will be noted that the effects of the shearing stresses are not taken care of so effectively as in Figure 5, C. It can readily be seen that the incisal step on the lingual surface (Fig. 5, B) has weakened that portion of the incisal edge which remains. This step does offer slight resistance to the effects of the shearing stresses, but at the expense of valuable tooth structure. In many cases, the remaining tooth is so thin and translucent that when the crown is cemented in place, there is a discolored area in this vicinity. For this reason, many operators advocate the omission of this step (Fig. 5, A), thereby completely ignoring the importance of controlling the effects of the shearing stresses.

Fig. 11.—Left to right: Central incisor, cuspid and bicuspid and their respective three-quarter crown preparations.

A cross-section through the contact points of the tooth and casting (Fig. 5, I) shows how the casting, the tongues of which fit into the lateral grooves which are labially to the contact points and at the periphery of the prepared area, engages the tooth so that the effects of the rotating stresses are mechanically controlled and thereby not permitted to act on the cementation.

The effects of the rotating stresses in the other types of three-quarter crowns (Fig. 5, J) are not taken care of so effectively. The lateral grooves, the incisal ends terminating on the lingual surface, pass lingually of or, at best, through the contact points and, owing to their size

and position, leave but a small portion of the tooth to be engaged by the crown.

As regards the mesial and distal grooves in other types of three-quarter crowns, some operators make them with a tapering bur, allowing them to fade out at the gingival ends; others use a cross-cut fissure bur and make the grooves to the depth of at least one-half the width of the bur at the gingival aspect, but in both methods the incisal ends of the grooves terminate on the lingual surface, forming wedges with no provision to control their action. If the cross-cut fissure bur is used, resistance is increased at the gingival end, but it is too far from the point of stress to be effective. The V-shaped pieces of tooth formed by the grooves and the lingual surface are, owing to the ineffectiveness or absence of the incisal step, the points that must bear the force of the shearing stress. (Fig. 5, D and E, x.) It certainly is not good engineering to expect two frail V-shaped pieces of tooth structure to take care of all the forces of mastication in a three-quarter crown.

It will be noted (Fig. 5, F) that the incisal ends of the lateral grooves of this preparation end in the incisal step or become a continuation of the incisal step or groove. These grooves and the step, being 0.5 mm. deep from the outside surface of the tooth, do not encroach on the pulp. They are placed in areas that are readily accessible and are not sensitive, and therefore the pulp is not irritated during the preparation and is not subjected to thermal reactions afterward. As the preparation did not leave the tooth, or any part, weakened or sensitive, there is no need of protecting it between sittings.

In the other types of preparations, the grooves are put in after the bell portion has been removed, and, owing to their position and depth, are dangerously near the horns of the pulp. Many operators find it necessary to use an anesthetic to place the grooves. The proximity of the grooves to the pulp endangers the pulp during the preparation and many times causes disagreeable postoperative thermal reactions, with subsequent death of the pulp.

It will be noted that, in this preparation, no tooth structure has been removed unless some mechanical advantage has thus been gained. It is inadvisable to remove tooth structure that has mechanical or retentive value, and equally so to remove tooth structure if its removal leaves the remaining tooth weakened. The removal of any tooth structure from the lingual surface for the purpose of retention is a waste of good structure and shows a disregard for the principles of mechanics. The strength of a preparation is not enhanced by the size or depth of a groove, but by its position, and the amount and strength of the tooth structure behind that groove.

After the bell portion of the tooth has been taken off in other preparations and the grooves have been cut with a bur, that portion of tooth structure lying between the bottom of the groove and the mesiolabial or distolabial angles is removed by means of a chisel or a disk. (Fig. 5, G.) It is approximately the labial half of this portion that is removed for the lateral grooves in this preparation. (Fig. 5, H.) Therefore, the removal of the lingual half and the portion for the groove itself is a waste of good tooth structure in these preparations.

The walls of the grooves are parallel with the enamel rods in the areas where they are placed, and thus no weakened or unsupported enamel rods are left. The grooves need not necessarily end in dentin: enamel is naturally built to withstand compressional forces. It should be remembered that the tooth in a three-quarter crown preparation is being shaped so that it can be held by the crown; whereas, in a cavity preparation for a restoration, the tooth must be so shaped that it will hold the filling.

THE CASTING

It will be noted that the casting engages the tooth in such a manner that the effects of the forces of mastication are definitely controlled. The mesial and distal tongues are a continuation of that portion of metal which fits into the incisal step. They support the incisal hook and prevent it from opening labiolingually. That portion of the metal or casting which covers the incisal edge is angle-iron in shape and thus does not readily lend itself to bending. This gives the crown rigidity and prevents it from opening at the gingival portion. It will also be noted that the tongues are at the periphery of the casting, where they are most effective.

In examining the castings of the other types of three-quarter crowns, it will be seen that the tongues are not at the periphery, and therefore are not so effective, and it will be further noted that the preparations have not given the castings a shape that will resist the effects of the forces of mastication which cause it to buckle and open at the gingival edge.

Those who do not understand the mechanics involved in the construction of three-quarter crowns consider the gold responsible for "the opening at the gingival," when this is really due to improperly designed preparations. Therefore, neither the use of hard golds nor use of an increased amount of gold at the cingulum, such as some advocate, has remedied this condition. The use of the incisal step does permit an increase in the bulk of material, but bulk does not produce the rigidity that can be obtained by proper shape.

Some operators advocate the use of a pin in the cingulum for retention. This pin may aid in the control of the shearing stresses, but as it is out of proportion to the amount of force it is called on to withstand, it is not so effective for this purpose as is the incisal hook. Furthermore, the pin does not take care of the effects of the wedges, protect the incisal edge, facilitate successful cementation etc., nor does it give the desired shape to the casting as does the incisal hook.

CEMENTATION

In analyzing this preparation from the standpoint of cementation, it will be noted that the cement is not subjected to the effects of the forces of mastication, as these effects have been taken care of mechanically, and that there are irregularities at the periphery of the preparation and casting which prevent the washing out of the cement; also, the food passes at right angles over the junction of the crown and the tooth at the incisal aspect, and therefore it cannot be forced between the tooth and casting, causing cleavage.

Other types do not lend themselves to successful cementation because the effects of the forces of mastication have not been definitely controlled, and the cement, therefore, is constantly being subjected to these devastating forces. Furthermore, there are no irregularities at the periphery of the prepared cavities and castings to prevent washing out of the cement. Those who do not use a lingual step provide no irregularity from the incisal edge to the gingival aspect.

Those operators who in cemented restorations rely on the mechanics of a wedge or taper with the theory that "the harder they bite on it, the tighter it fits" surely do not understand the mechanics of cementation. This theory involves movement, and movement in cementation means failure. Anything to be cemented should have a positive and definite seat. Cement cannot compensate for poor engineering. Perfect fit or adaptation is a thing to be desired, but when not accompanied by the application of engineering principles, it means failure, regardless of the materials used. In other words, a prosthesis made for a prepared cavity without mechanical retention, no

matter how well it fits, and whether made of hard or soft gold or of whatever material, is a failure regardless of how good the cement is.

As regards the posterior preparation and crown, it will be noted that definite provisions are made to take care of the stress on the bearing surface; that is, the stress from the lingual toward the buccal aspect is taken care of by the lingual portion of the crown, whereas the stress from the buccal toward the lingual aspect is taken care of by the step at the buccoclusal angle. This step provides an irregularity at the periphery of the preparation which makes it favorable for successful cementation and imparts to the crown a shape that gives it rigidity. The step also brings the periphery of the crown into a self-cleansing area, the food passing at right angles to the junction of the tooth and crown, with no chance for cleavage. The crown in turn protects the cusps and has a bulk of material at the periphery for finishing. In regard to the mesial and distal grooves, as the gold must come far enough toward the buccal aspect to be in a self-cleansing area, this is the place for the grooves, just lingually to the mesiobuccal and distobuccal angle that is formed when the bell portion has been removed. This causes the tooth to be engaged buccally to the contact points, therefore the greater bulk of the tooth is within the grasp of the crown.

In examining the preparation and casting of the ordinary three-quarter crown for posterior teeth, the question arises why a groove is placed on the occlusal surface between the cusps and then continued over on the mesial and distal aspects, thereby engaging only the lingual portion of the tooth, which is smaller than the buccal and must be reduced by removal of the bell portion and for clearance of the bite. When the gold must extend buccally to the contact points into immune areas, why not take this additional tooth into the grasp? Why have long uninterrupted surfaces between the buccal aspects and the mesial and distal grooves for the cement to wash out when it could be protected by the irregularity produced by a groove at the buccal periphery?

It will also be noted that the design of this preparation is such that the distance between the point of stress and the point of resistance has been kept to a minimum, and thereby levers are eliminated or kept as ineffective as possible; and the margins are brought into a self-cleansing area, especially at the mesiolabiogingival and distolabiogingival angles; which is not true in other preparations.

The technic is simple, requiring no special instruments or materials. The method of preparation gives the operator ample opportunity to make many changes as the preparation progresses, without defeating his purpose or destroying the tooth.

Because of their resistance to wear and less conspicuus color, the hard golds are indicated in certain cases. Crowns and abutments made of 22-carat gold on this preparation have stood the test of time, through the years since 1922, and have not had to be recemented.

The principles in this preparation are applicable to all types of teeth, thick or thin, long or short, upper or lower, anterior or posterior, regardless of the bite, and are especially applicable to thin anterior teeth and the lower incisor teeth. To illustrate what can be done on a thin tooth, a preparation was made on a portion of a penny, cut to resemble a tooth with the bell portion removed, using the face as the labial aspect and the back as the lingual. Grooves were cut on the edges and enough was removed from the back for the thickness of the metal. Then a casting was made to fit, restoring the penny to its original thickness.

This preparation can be used not only for abutments, but also for individual crowns and for restorations.

If the bite is to be opened, the anterior teeth are generally worn quite thin, but the pulps are still alive. These teeth can be built up with this type of three-quarter crown, owing to the size and position of the grooves, without weakening the remaining tooth structure or interfering with the pulp.

In young patients with a corner of an anterior tooth accidentally broken off and the pulp nearly exposed, it is possible to make a restoration with this type of three-quarter crown with the removal of very little tooth structure, just enough for clearance of the bite and the bell portion without further pulp irritation, because of the depth and position of the grooves.

This type of three-quarter crown will be found very useful when there are large cavities on the mesial and distal aspects of an anterior tooth and the pulp is still vital, and the patient is either too young for a porcelain jacket crown or unable to afford one. It is suggested that the cavities be thoroughly cleaned out and filled with cement and no bell shaped area or undercuts be left. The incisal step is made as described above. As grooves in cement are of no value, it may be necessary to make the lateral grooves farther toward the labial aspect and perhaps even on the labial surface and keep the walls of the grooves parallel with the enamel rods in the area where they are placed. This means the showing of a large amount of gold, but should a patient have to lose a tooth because he cannot afford a porcelain jacket crown, and the restoration does not come up to our ideal of esthetics?

This preparation does not show any more gold on the mesial and distal aspects than does any other preparation that brings the periphery into a self-cleansing area, where good dental practice requires it to be. It is necessary, however, to show not more than 0.5 mm. more gold on the incisal edge than in other types of preparations. This gold can be improved esthetically by proper rounding or contouring. Esthetic values are very important, it is true, but they can be overrated. Neither the patient nor the operator should object to this slight additional gold when they realize that it (1) protects and strengthens the incisal edge; (2) provides a definite seat for the casting; (3) prevents the wedging action of the tooth from becoming effective; (4) efficiently takes care of all shearing stresses; (5) prevents the crown from buckling and opening at the gingival portion; (6) gives bulk of material for finishing; (7) facilitates successful cementation, and (8) keeps the distance from the point of stress to the point of resistance at a minimum.

We must cater to the wishes of our patients, but when we let their whims take precedence over our better judgment, we cease to be professional and are deceiving both the patient and ourselves, and are laying up trouble for both of us.

SUMMARY

Certain advantages of the preparation here described are:

1. A practically painless preparation, with no pulp irritation during or following preparation, no anesthetic needed and no protection of the tooth required between sittings.

2. The minimum amount of tooth destruction consistent with maximum strength and extension for prevention.

3. No weakening of either the tooth or any part of it by the preparation and no unsupported enamel rods, with protection of the incisal portion of the tooth by the crown and, in turn, definite support for the crown at this point.

4. Positive provisions for the tooth and crown to withstand the forces of mastication by controlling the wedging effect of the tooth and the effect of stress on inclined planes.

5. A preparation suitable for all teeth regardless of size, shape, thickness or intermaxillary relationship.

6. A simple technic, requiring no special instruments or materials.

7. A suitable preparation for successful cementation.

8. The minimum of visible gold consistent with good construction.

9. Elimination of levers or control of their effects.

10. A shape given to the crown that enables it to withstand the forces to which it is subjected.

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LOWER DENTURES

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A REVIVED interest in the construction of lower dentures is indicated by the attendance at this meeting. Have lower denture failures developed this interest? Or is it the desire to succeed that makes the construction of lower dentures, as well as upper dentures, so fascinating? I wish to increase this interest by presenting the practical experiences of many dentists, including my own.

Dentists have long accepted Gray's and Cunningham's recorded work on mandibular musculature as final, believing that nothing further could be added by research. Now another chapter, a remarkable contribution of Hugh W. MacMillan,[1] must be added on mandibular musculature. Dentists who have accepted and made use of these new anatomic facts presented by Dr. MacMillan are constructing very much better lower dentures than they had ever hoped to make.

Since the technic of taking lower impressions which is outlined later is largely based upon these new anatomic findings, it will be necessary to quote frequently from Dr. MacMillan's article.

The present custom of extending lower dentures for stability to far greater limits than is usual prompted an inquiry by Dr. MacMillan into the nature of the structures supporting the extended dentures. An effort was made to determine the farthest edge or boundary to which they may be extended. He writes:

> The proper approach to such a study is from the standpoint of myology, not osteology. Too many technics in dentistry, even prosthetic dentistry, have been founded on the anatomy of the dry maxillary bones. . . . As usually seen in the cadaver, the teeth of the opposing series are slightly apart—the position of rest in the living. It is important that this fact be recognized when clinical application involving anatomic mechanisms are made from dissections. It is interesting to contemplate that, in the patient, the normal relations of the parts inside the mouth proper cannot be observed by the examiner. As soon as the mouth is opened, the parts are put on tension, muscles have come into play and everything contained within the mouth assumes a relationship far different from that of the structures at rest or during functional

Read before the Section on Full Dentures at the Seventy-Fourth Annual Midwinter Meeting of the Chicago Dental Society, February 16, 1938.

1. MacMillan, H. W.: Anatomy of Throat, Mylohyoid Region and Mandible in Relation to Retention of Mandibular Artificial Dentures. J.A.D.A., 23:1435, August 1936.

excursions. These abnormal relationships are too often obtained in taking impressions. The resulting prostheses are constructed over casts that do not portray the relationships of rest or function or the happy medium.

There are two areas consisting of muscle and soft tissues which are not generally utilized for retention of dentures. One area is termed the buccal pouch, the other the sublingual space.

BUCCAL POUCH

The buccal pouch is an area with little muscle tone located below the gingival region of the lower first molar. This pouch can be located by placing the forefinger in the mouth opposite the lower first molar region. When the finger is permitted to drop toward the apices of the molar, it will fall into this pouch. With the finger in this region, the teeth are brought into firm occlusion by contraction of the masseter muscle. The posterior border of the buccal pouch will be found to be the anterior fibers of the masseter muscle. Now, the forefinger is brought forward into the buccal pouch and the fact that the anterior border is limited by the posterior fibers of the depressor anguli oris or triangularis becomes evident.

In the average mouth, the buccal pouch will accommodate a good-sized bolus of food. Likewise, the buccal pouch may accommodate the finished denture over which the fibers of the buccinator muscle will fold, aiding in retention.

SUBLINGUAL SPACE

In MacMillan's article, we read:

The "discovery" of the muscular partition between the sublingual space and the fauces and the pouchlike formation of the posterior portion of the sublingual space has been illuminating to prosthetists. In the living patient, when the mouth is open wide for examination, the structures forming the posterior boundary of the sublingual space are hidden from the examiner by the tension of the muscle fibers of the anterior palatine arch and can be demonstrated only with difficulty.

In one sense, this is not a space when the tissues are at rest. The tissues forming the boundaries of the sublingual space may be described as follows: The sublingual space is bounded on the lingual aspect by the tongue muscles. The buccal boundary of this space is limited by the mylohyoid muscle and the mandible. The inferior boundary is formed by the mucous membranes covering the submaxillary and sublingual glands. The posterior boundary is formed by the anterior aspects of the glossopalatine muscle and the lingual portion of the superior constrictor of the pharynx.

The sublingual space may be demonstrated by using the mouth mirror to move the tongue to one side, at the same time instructing the patient to place the tip of the tongue lightly against the lower lip and to relax the tongue muscles as much as possible.

In a cadaver, this area is distinguished and demonstrated in the best way. It was on a cadaver that Dr. MacMillan demonstrated the posterior boundary or partition formed by the anterior palatine arch which separates the sublingual space from the fauces.

When the mouth is open wide and the tongue is contracted toward the throat, the sublingual space is so distorted that the anatomic boundaries of this area assume a relationship far different from that which could be satisfactorily utilized in prosthesis.

OVEREXTENSION AND OVERCOMPRESSION

Experience has taught us that many common errors are made in lower impressions; for example, in overextension or displacement, and overcompression of tissues. Overextension is in one sense a stretching of tissues by the periphery of an impression or a denture which apparently changes tissues from their nor-

mal working position. Generally, the changing of the normal working position of tissues in mouths with little or no ridge by the periphery of the impression or finished denture results in the dislodging of the impression or denture by these tissues.

If overextension takes place in mouths with very large ridge areas, the ridge adaptation is extensive enough to resist displacement of the denture. In such cases, overextension of the denture soon cuts the periphery tissues. Few patients can or will tolerate cutting of border tissues until scar tissues are formed.

Overcompression is in one sense pressing together layers of tissues covered by the denture. This will sometimes dislodge a denture, cause soreness and encourage atrophy, which results in destruction of the adaptation of the denture. Furthermore, the so-called postdamming of the lower impression, when reproduced in the denture, is only a temporary retention measure and causes both soreness and atrophy.

Overextension and overcompression by use of too large an amount of impression material or an oversize lingual flange of a denture can separate the sublingual tissue folds and change the sublingual space into one that is distorted and abnormal in size and shape. Such a space is undesirable, as it interferes not only with the function and stability of the denture, but also with the normal functions of the tissues involved.

The posterior dislodgment or "kicking up" of the heel of the impression and denture is caused many times by stretching and compression of the anterior fibers of the temporal muscle by the impression or the denture. This interferes with the function of the fibers of the temporal muscle. Sometimes, these fibers are attached as far down on the ramus as the posterior boundary of the retromolar triangle. Frequently, the mylohyoid fibers, which are attached to the posterior extremity of the mylohyoid ridge, extend upward and are attached high on the inner surface of the ramus near the anterior border and are the antagonists of the anterior fibers of the temporal muscle. The stretching and compression of these mylohyoid fibers will also cause posterior dislodgment of the impression or denture. The changing of the working area of the superior constrictor muscle and the overextension and compression of the pterygomaxillary ligament which is attached to the posterior extremity of the mylohyoid ridge will likewise dislodge the impression or denture. In such cases, the impression or denture cannot be called functional.

EFFECT OF MUSCLE TONE OR TENSION ON IMPRESSIONS

Tissues with little tone or tension are more easily overextended and overcompressed than those with marked tissue tone or tension. Especially is this noticeable in the lingual tissues. Consequently, there is not so much tone in the lingual tissues to aid in trimming the lingual periphery border of the impression as in the tissue bordering the buccal and labial periphery of the impression. The mylohyoid muscle is of special interest because it functions below the mylohyoid ridge, whereas the genioglossus, the other important muscle involved in the peripheral contouring, can function above the level of the mylohyoid ridge, the same as the labial and buccal muscles. When the genioglossus extends the tip of the tongue forward and upward, its attachment to the genial tubercle will trim the impression material. Meanwhile, the mylohyoid muscle is in a noncontractile state and so lacks tone and tension that it is unable to mold a periphery of an impression. Hence, we can expect overextension and compression of the mylohyoid muscle, unless the periphery contouring is done by muscular action, such as opening, closing and swallowing many times. Since

the mylohyoid muscle is the principal depressor muscle involved in the opening after the external pterygoid starts the opening from centric occlusion, it will shape the periphery better if force is used to resist the opening somewhat. This is done by placing both thumbs against the lower border of the mandible and pressing upward with force, at the same time instructing the patient to open the mouth.

The tone of the buccal and labial tissues may be demonstrated as follows: The mouth is opened wide and the index finger placed against the masseter and buccinator muscles opposite the lower second or third molar. Evidently, there is not much tone or tension. One can readily see how the impression material can stretch tissues in this region beyond their normal working area. The harder it is for the impression material to flow, the greater the stretching or oxerextending. Next, with the index finger still in the same region, the teeth are brought into centric occlusion and the masseter and buccinator muscles are contracted. The firm contraction of the anterior fibers of the masseter muscles is evident. The buccinator likewise takes on a different form. Now, with the teeth still in centric occlusion, another accessory muscle of mastication, the orbicularis oris, is contracted. This too, as you know, takes on many different forms.

This demonstration should further convince us of the need of taking lower impressions under similar conditions of tissue contraction; which means also that centric relation can be an aid in taking impressions. Furthermore, for the best results, centric position must be established at the place where it existed prior to extraction.

It is necessary to digress to consider the use of the tactile muscle sense of centric occlusion in securing centric relation. The term "tactile muscle sense of centric occlusion" is not generally known and not described in dental literature. It is explained as follows: When the natural teeth come into centric occlusion, reflexes stimulate the masticatory muscles until their strength is dissipated or scattered. Other reflexes stimulate the external pterygoids to action in separating the teeth from centric occlusion and starting the opening movement; after which reflexes stimulate the depressor muscles to action and complete the opening of the mandible.

These reflexes also occur in crushing or attempting to crush a hard bolus of food; for example, a cherry seed or hard piece of candy, when the teeth are not in centric occlusion. This is a highly specialized arrangement. These reflexes remain after the extraction of all the upper or the lower teeth, or both. If these reflexes did not remain after extraction, patients with dentures could never open their mouths, regardless of where centric occlusion was established. It is at centric occlusion that the tactile trigger-like action of the teeth sets up the defense reflexes ending the upward movement of the mandible. Likewise, the trigger-like action will set up these reflexes at centric occlusion upon hard occlusal rims of the impression tray or well-fitting base-plates.

In the edentulous, it is through these reflexes that centric relation is easily established and used in taking functional impressions. The use of these reflexes is the keynote to successful functional lower dentures because it permits the maximum muscle power to adapt the impression material. This is accomplished as follows: A snap or preliminary impression is taken with the patient's tongue protruded and the mouth wide open, while the operator pulls upward on the buccal and labial tissues attached to and below the external oblique line. The better this preliminary impression, the better the final impression. A plaster is used that, at a certain stage, which may be called the whipped cream stage, is plastic enough to be read-

ily molded by the tissues with a minimum amount of extension and compression. Most compound impression material requires considerable pressure to cause it to flow. A plaster cast is now made, over which a white vulcanite tray is to be made. The reason for using white rubber will be explained later. White rubber is dissolved in chloroform and painted on the cast; which makes it possible for the rubber to be ironed on the cast and thereby reduces the time. The periphery toward the crest of the ridge is strengthened for about 2 mm. with another thickness of vulcanite, the denture vulcanized and the plaster polished off.

We are now ready to use the tray in the mouth. The next step is very important. With an indelible pencil and the mouth wide open, the mucobuccal and mucolingual folds are marked. These folds should not be distorted or stretched. The tray is inserted and, since the tray is white vulcanite, the outline of the indelible pencil on the tissues will show on the tray. The tray is now trimmed to outline. It should be remembered that we are approaching this problem from the standpoint of myology, not osteology. The patient is instructed to extend the tongue forward and to relax the tongue muscles as much as possible, the operator at the same time using the mouth mirror to move the tongue to one side. This action makes it possible to mark with indelible pencil the sublingual space. The tray is inserted and the patient is instructed to again protrude the tongue. The tray is removed and trimmed to the pencil mark. This marking is repeated on the labial and opposite sides. If this trimming is done carefully, the white vulcanite impression tray will be seated upon the ridge and will not be dislodged with the opening of the mouth and the protruding of the tongue.

Black tray compound is used for this occlusal rim. This is sealed tightly with dry heat upon the vulcanite tray. We are now ready to make use of the tactile muscle sense of centric occlusion that existed prior to extraction, to secure centric relation. The procedure is as follows: The edentulous patient is told to place his jaw "where it feels most comfortable," or to relax or to swallow. After he swallows, his jaw returns to the rest position. The patient is told to close until he feels that he would be touching his natural back teeth. These directions are given slowly and deliberately, as this is a new experience to the patient. The patient is told to repeat placing the jaw in these two positions. Of course, he at first thinks that he cannot do this. He is assured that he can, to make him feel more confident. This is such a new and simple procedure that even dentists have not recognized it. After the patient has become acquainted with this procedure, the vulcanite tray is inserted with the compound occlusal rim constructed so that it is in even contact with the upper rim or natural teeth while the jaw is in rest position. The occlusal rim of the lower tray is softened with a blow torch and inserted in the mouth. Softening is very important. Compound softened insufficiently (too hard) or oversoftened causes failure, as it interferes with the normal reflexes that were associated with the natural teeth in centric occlusion. The patient is told to imagine that he has all his natural teeth and to chew into the softened compound rim until he thinks that his natural back teeth would be touching, or until he can imagine himself clinching his back teeth. We then find that his tactile muscle sense of centric occlusion will stop the mandible as it did prior to extraction.

We are now ready for the functional impression to be taken with two kinds of wax, a hard wax with a melting point around 135° F., and a softer wax with a melting point around 124° F. Both will soften and flow easily at body temperature. The waxes are compounded with

paraffin, beeswax, petrolatum and vegetable dye. This procedure is called "functional impression" taking because it will be made during many functional excursions of the mandible similar to the incising and masticating of food, swallowing and any other opening and closing movements of the mandible in which the tissues of the sublingual space and other oral tissues are involved. Furthermore, in these functional wax impressions, overextension and compression are practically eliminated in mouths with a great amount of tissue tone, and are greatly reduced in mouths with little tissue tone. After the wax has been softened by the body heat, the peripheral tissues will push the wax out of their way and contour it for their movements. Hard wax is first painted on the tray with a small brush, after the wax has been melted with the double boiler method of heating. More hard wax is easily applied to secure adaptation or until the tissues have made one continuous and smooth imprint. The softer wax is next painted over the hard wax, which has a melting point of about 124° F. It will soften and flow easier than the hard wax at body temperature. More soft wax can be applied just as the hard wax to secure adaptation or until it takes on a surface that is a smooth and continuous imprint of the fine lines of the mucous membranes covering the ridge and peripheral tissues. It is here that the vegetable dye gives the wax a more visional imprint of the tissues. The reproduction of all the peripheral border is necessary in pouring the cast, as a guide to the finished dentures.

COMMENT

Lower functional impression taking can be done in the following steps: 1. A thorough anatomic examination. 2. A preliminary impression in plaster or any material in order to reduce overextension and overcompression. 3. The making of a white vulcanite impression tray. 4. Outlining, with soft indelible pencil, of the mucobuccal and mucolingual tissue folds bordering the ridge. 5. Insertion of the white vulcanite tray and registration of the indelible outline on the tray. 6. Trimming of the white vulcanite tray to the indelible outline. 7. Building of a rigid and high fusing compound occlusal rim upon the tray. 8. Establishment of centric relation through the use of tactile muscle sense of centric occlusion existing prior to extraction. 9. Employment of centric relation, the vulcanite tray and the wax impression material together to secure a functional lower impression.

SUMMARY

1. Lower dentures can be more successfully constructed if the approach is from the standpoint of myology instead of osteology.

2. A functional lower impression as outlined permits the peripheral and denture bearing tissues to function histologically and anatomically, aiding in the denture's stability and permanency.

3. Finally, the apparent ever-returning of lower denture patients to our offices for trimming, adjustments and complaints is practically eliminated.

720 Fidelity Building.

EAR DISTURBANCE OF TEMPOROMANDIBULAR ORIGIN

By Ross F. Bleiker,* A.B., D.D.S., St. Louis, Mo.

IT is not my desire to encroach on the field of otology, but it must be recognized that when ear disturbances are diagnosed as of dental origin, and referred to the dentist with special training in this field, it becomes necessary for him to determine the cause of the disturbance. This requires definite fundamental anatomic knowledge of the temporomandibular region, as well as knowledge of the physiologic action of the temporomandibular articulation. Appropriate treatment can be instituted only when the anatomic and physiologic causes of the disturbance are understood.

In making a detailed study of the anatomic factors involved in ear disturbances associated with changes in the resting position of the mandible, several dissections were made, at St. Louis University, of the temporomandibular region, giving special attention to the glenoid fossa. This fossa is divided into two parts by a small slit called the petrotympanic fissure, which extends mesially and laterally, nearly parallel with the head of the condyle when the teeth are in normal occlusion. At a depth of 2.5 cm., the fissure is more nearly parallel with the head of the condyle than at a lesser depth, since the chorda tympani nerve and anterior tympanic artery leave the range of the condyle head at the depth of 2.5 cm., in most cases. The anterior tympanic artery, which supplies the anterior two-thirds of the tympanic membrane, and the chorda tympani, which passes between the malleus and the incus, pass through the petrotympanic fissure; therefore, pressure of the head of the condyle on the artery and nerve would create an ear disturbance.

Since the chorda tympani contains both motor and sensory fibers, any irritation at the point of its entrance into the petrotympanic fissure by the head of the condyle would stimulate these fibers and cause a disturbance of the middle ear. Whether this disturbance is produced directly through the sensory nerve fibers or through reflexes would not change the condition. The point of stimulation would remain the same, occurring on the mesial side of the glenoid fossa.

Sensory nerve fibers within blood vessel walls have been demonstrated, and therefore it is reasonable to suppose that such fibers are contained within the anterior tympanic artery, which supplies the greater portion of the tympanic membrane. Irritation of these fibers alone might be sufficient to produce ear disturbances. In extreme abnormal cases, in which the cartilage has been partially destroyed, and the head of the condyle thus permitted to ride upon the glenoid wall, a change in blood pressure of the artery leading to the membrane could create the stimulus.

The chorda tympani and the anterior tympanic artery would most likely be affected first, because of their close relationship to the head of the moving condyle, rather than the auriculotemporal nerve, which lies somewhat inferiorly. Therefore, the petrotympanic fissure is a definite landmark for determining the

Read before the St. Louis Section of the International Association for Dental Research, March 28, 1938.

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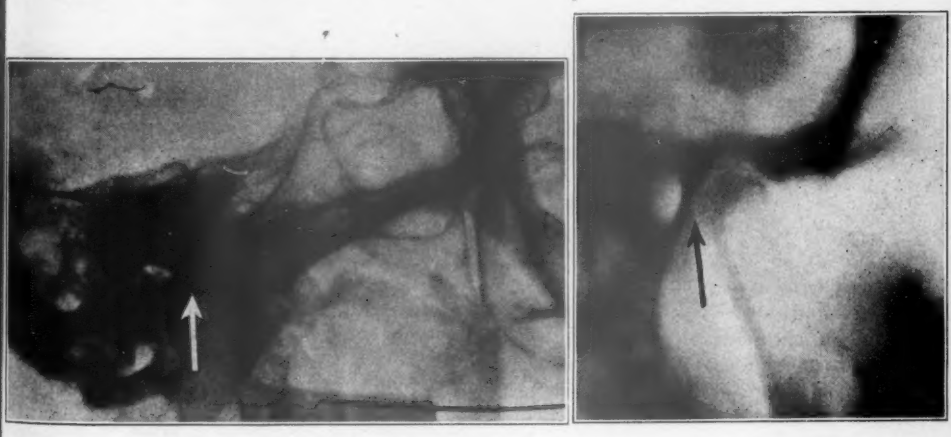
correct relationship between the mandible and the maxillae when the teeth are in normal occlusion.

petrotympanic fissure because of the superimposition of the zygomatic arch, as well as the bony structures of the oppo-

Fig. 1.—Prepared specimen from which idea of possibility of making laminagrams to show petrotympanic fissure was conceived. 1, zygoma removed. 2, masseter muscle removed from external surface of ramus. 3, insertion of external pterygoid muscle. 4, meniscus. 5, lateral surface of head of condyle removed. 6, parotid gland. 7, external acoustic meatus. 8, temporal muscle.



A B

Fig. 2.—A: Roentgenogram of prepared specimen showing petrotympanic fissure. B: Laminagram of clinical case showing head of condyle anterior to petrotympanic fissure.

In making an extra-oral roentgenogram through the head of a clinical patient, it was impossible to show the

site side. Because of this failure, a prepared specimen (Fig. 1) of a sagittal section of the head, made by sawing out

the zygomatic arch, was roentgenographed. This roentgenogram (Fig. 2A) clearly showed the petrotympanic fissure and the head of the condyle lying anterior to the fissure, with the teeth wired in normal occlusion.

These findings suggested the use of the laminagraph. (Fig. 5.) Through the courtesy of Dr. Sherwood Moore, of the Edward Mallinckrodt Institute of Radiology, Washington University, St. Louis, a laminagram (Fig. 2B) was made of a patient of mine by Dr. William Y. Burton, with the focus at a depth of 2.5 cm. The teeth were in normal occlusion. The laminagram showed the head of the condyle anterior to the fissure, corresponding identically to the extra-oral roentgenogram of the prepared specimen. (Fig. 2A.)

tient was of a nervous temperament. Low sounds were not audible in the left ear. There was occasional pain in the vertex region. There was a complaint of salivary disturbance and slight pain. The correct condyle-glenoid relationship was established by use of a laminagraph, showing the condyles anterior to the petrotympanic fissure. Dentures were constructed, balancing the occlusion. Slight improvement in hearing was evident after six weeks.

Figure 6 shows a laminagram of the case on completion.

Check-up three months later (Fig. 7) definitely showed the heads of both condyles anterior to the fissure after the dentures had adapted themselves and were functioning successfully. There was a gradual improvement in hearing and no further salivary disturbance.

In this pathologic joint, there was evidence of irritation of the chorda tympani by the head of the condyle in making its mesial movement within the glenoid fossa. This apparently accounts for the low hum reported, the activation of the salivary glands and the pain in the tongue.

After the positioning of the heads of the condyles anterior to the petrotympanic fissure

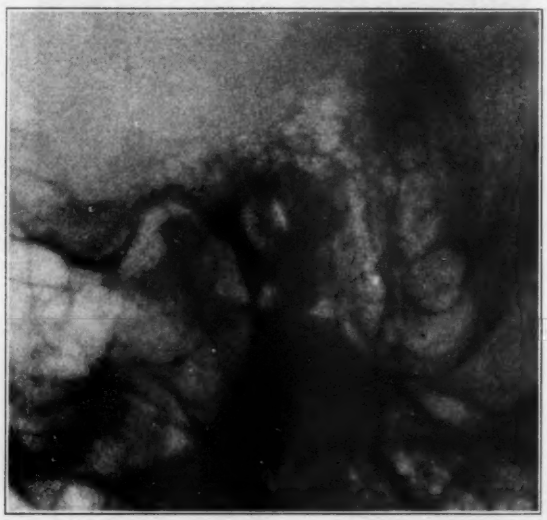


Fig. 3 (Case 3).—Roentgenogram showing temporomandibular region.

REPORT OF CASES

Case 1.—C. W. P., a man, aged 65, who had had the posterior teeth missing on the left side for several years, had poor occlusion of the opposite posterior teeth. The remaining teeth showed signs of abrasion. The pa-

and balancing of the occlusion, improvement was observed.

Case 2.—R. E. K., a man, aged 30, had suffered a unilateral loss of the posterior teeth of the mandible. There was a bridge on the opposite side. The teeth had been absent about seven years. There was no ear disturbance. Laminagrams show the difference in two joints, erosion of the left condyle head and destruction of cartilage.

Fig. 4.—Roentgenogram of specimen. A wire placed in the petrotympanic fissure represents the chorda tympani nerve.

In using bite-blocks to study condyle excursion, it is noted that there is a difference in the range of excursion or distance traveled from the petrotympanic fissure. The heads of the condyle are cut out at different levels, this indicating that the path is not in a straight line or the physiologic pattern as referred to by Lord[4] is different in the two sides. Some destructive changes occurring within the joint are caused by trauma.

While pathologic processes of the joints are not acquired suddenly, unless caused by traumatic injury, there are gradual changes continuously taking place within the capsule as the relationships of the mandible and the maxillae are disturbed. This trauma is reflected to the joint capsule in proportion to the number and position of the posterior teeth lost in the dental arches. As the trauma increases, arthritic conditions develop involving the capsule, membrane and meniscus. Later, they may even involve the head of the condyle and the walls of the glenoid fossa. Extreme thinness is noted and overclosure results.

Case 3.—F. W., a man, aged 43 had had a maxillary alveolectomy two years previously. (Fig. 8.) Resorption had continued. The vertical dimension was lost, overclosure resulting. The facial muscles were disturbed. The patient complained of tiredness in the region of the joint. Stuffiness in the ears was occasionally reported. No other ear disturbances had yet developed.

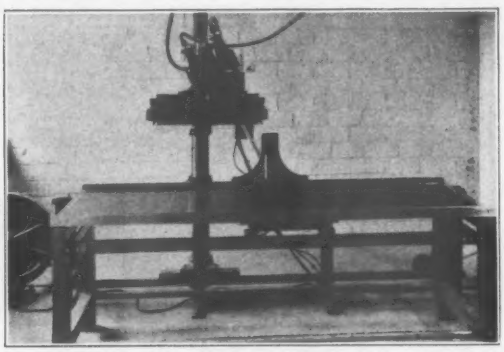


Fig. 5.—Laminagraph. (Courtesy of Sherwood Moore, M.D., The Edward Mallinckrodt Institute of Radiology, Washington University, St. Louis, Mo.)

This case shows the necessity of conservation of the maxillae in preparation of the

maxillary process for dentures. The obtuse angle formed between the ramus and the body of the mandible is unusual for a patient of this age. Bite-blocks placed in different positions show the changed position of the head of the condyle to the fissure.

ticular disk as described by Prentiss.[1] The looseness of the joint was attributed to overclosure caused by the early loss of posterior teeth on one side and accounting for the occasional stuffiness in the ear.

The change in depth, as shown by the

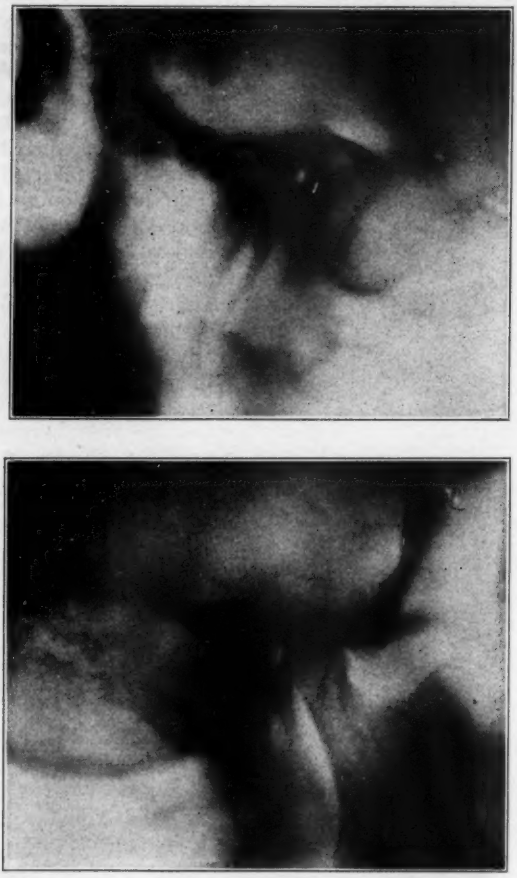


Fig. 6 (Case 1).—Above: Laminagram, left lateral view, focused at 2.5 cm. The occlusion is balanced and the head of the condyle is anterior to the petrotympanic fissure. Below: Right lateral view. (Figures 6-8 by courtesy of Sherwood Moore, M.D., The Edward Mallinckrodt Institute of Radiology, Washington University, St. Louis, Mo.)

The meniscus is slowly being destroyed. Figure 3 is a conventional roentgenogram of the case showing the temporomandibular region.

The occasional snapping noise heard was due to extreme thinness of the articular disk as described by Prentiss.[1] The looseness of the joint was attributed to overclosure caused by the early loss of posterior teeth on one side and accounting for the occasional stuffiness in the ear.

The change in depth, as shown by the laminagram of the lateral view of the head of the condyle, indicates that there was a widely shifting position in the closure of the mandible, as stated by Costen.[3] Although there was no perceptible change

observed clinically in this case, one would conclude that there was a change as the depth of focus was 2.5 cm. and was constant in the series of laminagrams. The gradual overclosure which has developed in the past two years was evidently a result of removing the thin septa of the maxillary process, and that resorption continued after the completion of dentures.

Fig. 7 (Case 1).—Above: Laminagram, left lateral view, focused at 2.5 cm. and taken as check-up three months after laminagrams shown in Figure 6. Below: Right lateral view.

THE LAMINAGRAM AS AN AID IN DIAGNOSIS AND TREATMENT

Since the use of the laminagraph in dentistry is new, it is interesting to note the records obtained by focusing at different depths from the zygomatic arch, and observing not only the petrotympanic fissure, but also pathologic conditions which I have been unable to reveal with the x-rays:

1. Focus depth with accuracy of the region desired, in millimeters.
2. Changes in vertical dimension and the relation of the head of the condyle to the petrotympanic fissure.
3. Fractures beneath the zygomatic arch.
4. Lateral erosion of the condyle head.
5. Excursion of the condyle up the glenoid fossa, with the fissure as an anatomic landmark.
6. Exploration of the glenoid cavity.
7. Localization of foreign bodies.
8. Localization of mandibular and maxillary third molars.

In making clinical studies of patients in whom ear disturbances occur, roentgenograms should be made as the preliminary examination. These will be of assistance in predetermining the depth of the layer to be taken with the laminagram.[5]

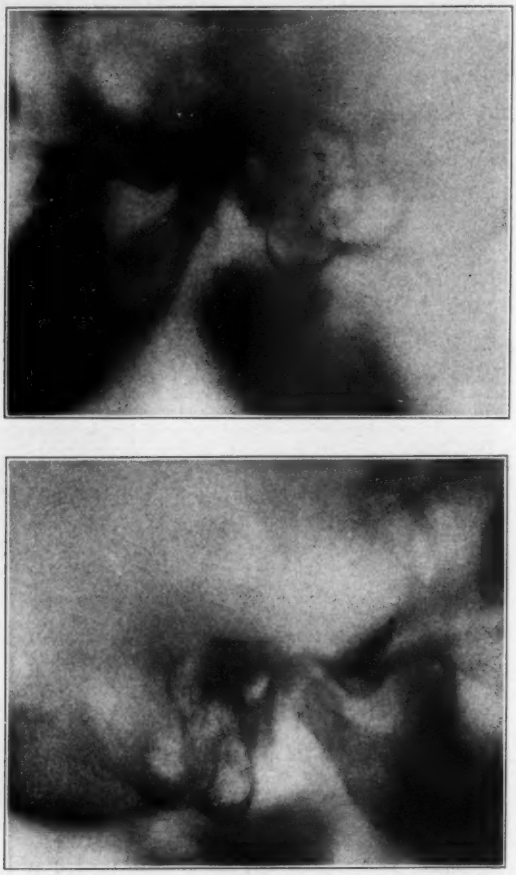


Fig. 8. (Case 3).—Above: Laminagram, left lateral view, focused at 2.5 cm. Below: Right lateral view.

The usual preliminary procedure in making lateral views of the temporoman-

dibular articulation is to focus the laminagraph at 2.5 cm. On interpreting this laminagram, the proper depth may be ascertained by making the focus more superficial or deeper, as the anatomic landmarks indicate. This change in depth may be from 1 to 2 cm., or even less, depending on the distance between the zygomatic arches. In making several exposures, using different depths, a more definite exploration of the glenoid cavity may be made.

It must be remembered that this joint is complex and the movements are many and varied. In making corrections of this articulation, we are attempting to restore the condition to normal, bearing in mind the masticating efficiency of the

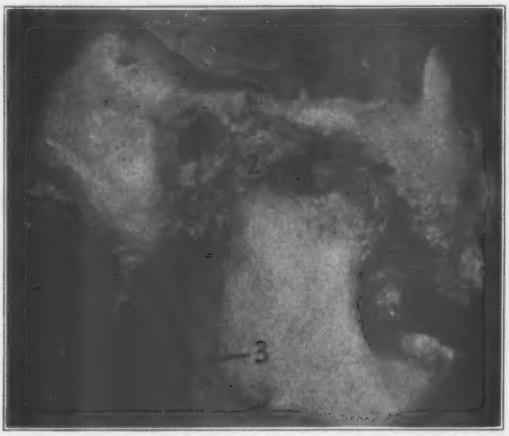


Fig. 9.—Relation of temporal muscle to zygomatic arch; dissection showing insertion of temporal muscle (1); external ligament (2), and stylomandibular ligament (3).

Fig. 10.—1, masseter muscle reflected. 2, facial nerve. 3, parotid gland removed. 4, external carotid artery. 5, stylomandibular ligament. 6, auriculotemporal nerve.

denture, whether we are building the occlusal surface of crowns of teeth, or making a replacement of either partial or complete dentures, or removable castings. The anatomy of the articulation must always be borne in mind.

The field is new and much is to be developed.

As a matter of information, the dental profession has been criticized for commercializing and attempting these so-called "bite-raising" cases. When a more definite standardized x-ray technic is developed, definitely showing the petrotympanic fissure and the impingement, as

Fig. 11.—Prepared specimen showing depth used to focus laminagraph; cutting out zygoma; glenoid fossa showing petrotympanic fissure and relation to middle ear. The chorda nerve passes through the fissure from the facial nerve to the lingual nerve. The anterior tympanic artery passes through the fissure from the internal maxillary artery to supply the anterior two-thirds of the tympanic membrane.

described, on the vein, artery and nerve lying in this fissure, greater results will be possible. To this end, the dental profession should strive.

CONCLUSION

1. Since there are many other factors in this dental problem which may cause ear disturbances, no definite and set rule can be followed, but it is well to note changes from some definite anatomic landmark, such as the petrotympanic fissure, which may be used as a guide in preventing overclosure or too great an increase in the vertical dimension.

2. The laminagraph, in focusing depth and eliminating the zygomatic arch, reveals the petrotympanic fissure, which is used as an anatomic landmark for registering changes effected within the joint and pathologic conditions not revealed by the conventional x-ray film.

3. To treat ear disturbances, a definite anatomic and clinical knowledge of the

Fig. 12.—1, external pterygoid on fovea of neck of condyle. 2, auriculotemporal nerve passing mesially to neck of condyle. 3, internal pterygoid origin. 4, eminentia articularis. 5, insertion into articular disk.

normal joint is necessary, and treatment must be planned over a period of time, with the cooperation and suggestions of the otologist.

4. Symptoms disappear in proportion to the restoration of the physiologic function of the temporomandibular joint.

BIBLIOGRAPHY

1. Prentiss, H. J.: Regional Anatomy Emphasizing Mandibular Movements with Specific Reference to Full Denture Construction. J.A.D.A., 10:1085-1099, December 1923.

2. Prentiss, H. J.: Preliminary Report

upon Temporomandibular Articulation in Human Type. *D. Cosmos*, 60:505-514, June 1918.

3. Costen, J. B.: Some Features of Mandibular Articulation as It Pertains to Medical Diagnosis, Especially Otolaryngology. J.A.D.A., 24:1507, September 1937.

4. Lord, F. P.: Movements of Jaw and How They Are Effected. *Internat. J. Orthodon.*, 23:557, June 1937.

5. Moore, Sherwood: Body Section Roentgenography with Laminagraph. *Am. J. Roentgenol. & Rad. Therap.*, 39:514, April 1938.

6. Kieffer, Jean: Laminagraph and Its Variations. *Am. J. Roentgenol. & Rad. Therap.*, 39:497, April 1938.

7. Kuntz, Albert: Pathways Involved in Pains of Nasal and Paranasal Origin Referred to Lower Cervical and Upper Thoracic Segments and Upper Extremity. *Ann. Otol., Rhin. & Laryng.*, 45:394, June 1936.

8. Harris, H. L.: Loss of Vertical Dimension on Anatomic Structures of Head and Neck. J.A.D.A., 25:175, February 1938.

9. Furnas, I. L.: Centric Relation in Full Denture Construction. J.A.D.A., 25:718, May 1938.

10. Stansbery, C. J.: Balanced Occlusion in Relation to Lost Vertical Dimension. J.A.D.A., 25:228, February 1938.

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BACTERIOPHAGE AND LYSOZYME IN RELATION TO ORAL INFECTION

By L. A. Sandholzer, D.D.S., Rochester, N. Y.

THAT bacteria and other microorganisms may be disintegrated by various chemical and biologic agents is common knowledge. Thus, the lysis of bacteria or erythrocytes by lytic antisera is employed routinely in the laboratory diagnosis of certain infections. The dissolution of the pneumococcus by bile or the solubility of the gonococcus in dilute alkali is also a valuable diagnostic criterion. In general, such lytic agents have been of more value in the laboratory than in the clinic because they are more efficient in test-tube reactions than as therapeutic agents. However, clinical claims have been made for two lytic agents, the bacteriophage and lysozyme, and it now seems worth while to examine them critically with the aim of interpreting our present knowledge in terms of clinical efficacy.

Before any rational therapy can be evolved, it is necessary to know something of the nature of the agents to be employed. In the case of the bacteriophage, the literature is confusing because, in the past, this agent has been employed zealously with an almost complete disregard of its nature and properties. It is the purpose of this paper, therefore, to call attention to those aspects of bacteriophagy and lysozyme activity which will make it possible to apply these agents intelligently, if experience shows that certain types of cases respond favorably. With this as the aim, bacteriophagy will be discussed first, and later on in the paper lysozyme activity will be given consideration.

The bacteriophage is an ultramicroscopic agent which brings about the complete or partial lysis of bacteria and which can be propagated indefinitely in the presence of living, susceptible bacterial cells. The earliest recorded observations on this phenomenon are those of Twort (1915), who reported a granular disintegration of a certain coccus which

Read before the Section on Therapeutics, Pathology and Research at the Seventy-Fourth Annual Midwinter Meeting of the Chicago Dental Society, February 16, 1938.

he had isolated from glycerinated calf lymph.

In 1917, d'Herelle isolated a lytic agent for dysentery bacilli from the stools of patients convalescing from bacillary dysentery. This agent brought about the complete dissolution of dysentery bacilli growing in liquid media and on solid media would reveal itself by giving the colonies of bacteria a "nibbled" appearance. D'Herelle showed that this principle was transmissible from culture to culture and that, during lysis of bacteria, it was regenerated. It was his contention that this agent was an autonomous living parasite of bacteria and so he called it "bacteriophage."

The phenomenon of bacteriolysis by the bacteriophage manifests itself in several ways. Probably the most dramatic aspect of its activity is the dissolution of growing bacteria in liquid media wherein the turbidity produced by the growth of the cells completely disappears in a short time (from one to three hours) when a few drops of an active lysate is added to the culture. Within a few hours, the previous turbid broth becomes as clear and limpid as the original sterile medium, and when lysis is complete, such cleared cultures are frequently sterile.

If susceptible cultures are mixed with a suitable bacteriophage and plates are poured with soft agar inoculated with this mixture, there will appear in the agar, after a period of incubation, clear, transparent, discrete areas where lysis has occurred. These areas are called "plaques" and represent "colonies" of bacteriophage. If the concentration of the bacteriophage is high, the plates may be sterile. If, instead of pouring plates with soft agar, the bacteria-bacteriophage mixture is streaked on ordinary agar, colonies will develop which show either the granular degeneration of Twort or the "nibbled" appearance described by d'Herelle. The two types of colony are frequently seen in the same preparation.

The actual lysis of the individual bacterial cells has been observed by a method of motion photomicrography (Bayne-Jones and Sandholzer, 1932). At least two types of lysis occur, one which is rapidly explosive, and another, which is a slow granular disintegration. In the first type, lysis is preceded by a series of increases in the total cell volume followed by a rapid "ballooning" of the cell and immediate subsequent lysis. In the second type, there is relatively little change in the cell volume and the organisms merely undergo a gradual dissolution, leaving behind a mass of granular débris.

The distribution of the bacteriophage in nature is probably as widespread as that of bacteria. It is frequently found in association with susceptible microorganisms. Water and sewage are the most common sources of this lysate, although it has been found in a variety of materials, including soil, milk and plants. Most of the groups of bacteria are susceptible to its action, and the only bacteria of medical significance for which no bacteriophage has been isolated to date are the pneumococcus and the influenza bacillus. Once isolated, the bacteriophage may be propagated indefinitely on a suitable living host, but it has never been propagated on any bacteria-free medium.

Many properties of the lytic principle are known, but only a few of them will be mentioned. Because of its small size* (from 10 to 100 mμ), it will pass through filters which hold back ordinary bacteria. This makes it possible to prepare lysates which are completely free of bacteria. Such filtrates are active even when diluted to 10^{-10} or higher (1 part of bacteriophage: 100,000,000,000 parts of the diluent). Its resistance to heat and ultraviolet light is somewhere between that of the vegetative bacterial cell and that of the bacterial spore. It is more resistant

*1 mμ = approximately $\frac{1}{25{,}000{,}000}$ inch.

to common antiseptics and germicides than are bacteria. Injection of the bacteriophage into animals promotes active immunity. Other factors, particularly the effect of body fluids, will be discussed later.

Up to this point, discussion of the bacterial host has been limited to mention of its rôle as an agent for the propagation of the bacteriophage; but in any host-parasite relationship such as this, the host is as important as the parasite. Most of the data concerning the host cells are too technical and hypothetical to be considered here, but a few points should be emphasized. A single strain of bacteriophage will react with only certain bacteria and usually all of the bacteria which react with such a lysate are members of the same or a closely related genus. Thus, it may be said that the bacteriophage is specific within the limits of the genus to which the host belongs. This must not be construed to mean that the specificity is of the same order as that of serums used in typing the pneumococcus. Other factors in determining whether lysis will occur with any given bacteria-bacteriophage mixture are: the antigenic nature and structure of the cells; the degree and kind of dissociation within the culture, and the age of the culture and the numerical ratio between the host cells and the bacteriophage particles. When all of these are taken into consideration, it becomes obvious that any prediction as to what a given bacteriophage may do to a given bacterium is impossible. Each organism represents an individual problem as far as bacteriophagy is concerned and the promiscuous use of so-called "stock" bacteriophages is absurd.

Five questions arise when an attempt is made to evaluate therapeutic procedures with the bacteriophage: 1. Has the etiologic agent been isolated in pure culture and is it lysed by the bacteriophage to be employed? 2. Is the composition of the lysate such that it can, independently of its ability to lyse the organism, affect the course of infection favorably? 3. What is the fate of the bacteriophage once it is introduced into the patient? 4. On the basis of the answers to questions 1, 2, and 3, is it reasonable to believe that the invading micro-organisms will be destroyed by the bacteriophage *per se?* 5. Can one be reasonably certain that the patient would not recover spontaneously? Or, in experimental infections, were adequate control experiments carried out?

The method of obtaining the answer to the first question has been implied in the foregoing discussion; namely, lysis in broth or plaque formation. The answer to the last question must be determined statistically on a valid series of cases. The other questions require further elucidation.

Eaton and Bayne-Jones (1934) have pointed out that lytic filtrates, although of unknown chemical composition, contain substances, aside from the lytic principle, which might make them valuable therapeutic agents. These substances are of two kinds: those present in the original culture medium and those derived from the host cells. The latter are all antigenic. Therefore, aside from actual lysis, beneficial results might be obtained because of protein shock or because the lysate was a good vaccine, or because of the presence of Besredka's (1927) antivirus.

The fate of the bacteriophage after its introduction into the body has been studied by Appelmans (1921), Sumiyoshi (1924), Eliava (1930) and Nungester and Watrous (1934). When ingested, it is apparently not absorbed from the intestinal tract and is rapidly eliminated in the feces and urine. It may accumulate in the spleen in considerable quantities and can be detected there five days after intravenous injection. The heart, liver, lungs, testicles and blood may con-

tain it in traces twenty-four hours after intravenous injection. If it reaches susceptible organisms and is absorbed by them, they may act as carriers and distribute it throughout various parts of the body. Apparently, inflammatory processes may cause it to localize at the site of inflammation. It is well to bear in mind that present knowledge is still quite incomplete and that unknown factors may influence the distribution in the body.

Since many body fluids and tissues actually inhibit lysis by the bacteriophage *in vitro,* it seems doubtful whether any beneficial results are due to the actual dissolution of bacteria in the body. Thus, it has been reported by a number of workers (Friedberger and Vallen, 1923; Clark and Clark, 1927; Applebaum and MacNeal, 1931, 1932; Evans, 1933, and others) that the bacteriophage is completely inhibited by whole blood, undiluted serum, bile, saliva, autoclaved intestinal mucus and tissue cultures. The following substances inhibit it under certain conditions: pus, urine, ascitic fluid and cerebrospinal fluid. In spite of these substances which inhibit lysis, however, the lytic principle may have a beneficial action in other ways. MacNeal and MacRae (1937) have recently verified earlier findings that the bacteriophage specifically enhances phagocytosis. Other indirect effects of which we have no knowledge at present may also take place.

The bacteriophage has been employed in the treatment of the following diseases: bacillary dysentery, Asiatic cholera, acute intestinal infections, infantile diarrhea, chronic enterocolitis, bubonic plague, furunculosis, osteomyelitis, septicemia, bacteremia, meningitis, genitourinary infections, wound infections, sprue, pyorrhea and gingivitis.

The methods of administering the bacteriophage have been numerous. Intracutaneous, subcutaneous, intramuscular and intravenous injections have been used. It has been given by mouth and by rectum. Local applications by instillation, irrigation or wet dressings have also been employed. The amounts used have varied enormously—from 2 cc. to 100 cc., given at frequent or wide intervals. In using MacNeal's (1932) special intravenous lysate, the usual dose is 75 cc. daily until the patient has a definite reaction. If the patient reacts before that amount has been given, no further bacteriophage treatment is given.

The treatment of oral infection with the bacteriophage has not received much attention. The work which has been presented is absolutely valueless because of the small number of cases and the total lack of controls. Two examples of such useless research are given below. Up to the present time, about thirty patients suffering from sprue, in which oral infection is but part of the condition, have been treated with a bacteriophage. Although Morison and Martin claim to have had "complete success" by treating it with a dysentery bacteriophage, and although d'Herelle has reported equally good results, Manson-Bahr, in the latest edition (1936) of "Manson's Tropical Diseases," does not even mention this treatment. Pitsch (1929) treated one case of pyorrhea with a bacteriophage. In his paper, no mention is made of the organism present or of the type of bacteriophage used. In fact, one gets the impression that he treated this one case very casually with some sort of bacteriophage and that incidentally, among other things, a cure was apparently effected.

The use of specific therapy in localized lesions of the mouth is not common. Aside from Goadby's recommendation of vaccine therapy, very little is being done along this line at present. However, the effectiveness of the bacteriophage in the treatment of pyodermia (Larkum, 1929; Crutchfield and Stout, 1930; Alderson, 1930; Kahn, 1931; Cipollaro and Sheplar, 1932) seems to indicate that it

might be valuable in the treatment of localized mouth lesions in which staphylococci are the primary cause of the disturbance. Thus, Raiga (1931) treated twenty-seven cases of oral abscess and ulceration of the connective tissue of the submaxillary region with staphylococcus bacteriophage. He claims to have obtained complete success in every case by merely injecting a potent staphylococcus bacteriophage directly into the abscess. In no case was surgical intervention employed and the patients all obtained relief from pain within about three hours. Morin (1929) treated fifteen cases of dental abscess by this technic with complete recovery in every case. Sauvé (1930) reported the case of a man with an enormous phlegmon originating in the second molar on the right side, and invading half of the cheek and the floor of the mouth. The patient was treated, without incision, by means of injections *in situ* of a bacteriophage, and recovered.

The results of the treatment of osteomyelitis by a bacteriophage have been less successful than the results of such treatment of pyodermia. This may be due, as Eaton and Bayne-Jones point out, to the presence of streptococci as well as staphylococci in these infections. Streptococcus bacteriophages are generally not so potent and are possibly more nearly species specific than most other bacteriophages. Usually, the bacteriophage is employed in conjunction with surgical procedures in treating osteomyelitis. Larkum (1929) and MacNeal (1931) reported favorable results in a small series of cases. Rice (1930) treated eleven cases with a bacteriophage with varying success. Bagley and Keller (1932) treated ten cases, also with variable results. In a similar series of cases, Boyce, Lambert and McFetridge (1933) found that although the patients obtained some relief, no definite cures were effected. This work seems to indicate that the bacteriophage is of doubtful therapeutic value in osteomyelitis.

In summary, it may be said that no significant work has been done on the use of the bacteriophage in oral infections. Although it undoubtedly will be no panacea in oral ailments, it may possibly prove to be of some value in certain localized infections. Caution must be used, however, in interpreting the results of such therapy unless a statistically valid series of controls are carried out simultaneously.

Lysozyme, the second bacteriolytic agent that we are to consider, is an enzyme which brings about complete lysis of certain bacteria. Fleming (1921) first noticed this bacteriolytic phenomenon in cultures of nasal mucus, although, as he points out, it had probably been observed long before this. Thus, in 1912, Rettger and Sperry were probably dealing with this phenomenon in their studies of the bactericidal power of egg white.

Lysozyme differs from the bacteriophage in several important respects. It lyses either living or dead cells; whereas the bacteriophage lyses only the living. The optimum temperature for lysozyme activity is about 60° C.; the optimum for bacteriophage lysis is usually that which is optimum for the host. Unlike the bacteriophage, it functions independently of the age of the culture, it is partially retained by filters which permit the bacteriophage to pass and, instead of producing discrete plaques in agar, it diffuses evenly, producing a broad zone of lysis. Two characteristics are alike in the two lytic agents (other than their ability to destroy bacteria completely): the regeneration of the lytic agent, and a certain degree of specificity, which is much broader in the case of lysozyme.

A wide variety of materials have been shown to contain lysozyme. Nearly all animal and human tissues contain it to some degree. In human beings, it has been found in all of the secretions, body

tain it in traces twenty-four hours after intravenous injection. If it reaches susceptible organisms and is absorbed by them, they may act as carriers and distribute it throughout various parts of the body. Apparently, inflammatory processes may cause it to localize at the site of inflammation. It is well to bear in mind that present knowledge is still quite incomplete and that unknown factors may influence the distribution in the body.

Since many body fluids and tissues actually inhibit lysis by the bacteriophage *in vitro,* it seems doubtful whether any beneficial results are due to the actual dissolution of bacteria in the body. Thus, it has been reported by a number of workers (Friedberger and Vallen, 1923; Clark and Clark, 1927; Applebaum and MacNeal, 1931, 1932; Evans, 1933, and others) that the bacteriophage is completely inhibited by whole blood, undiluted serum, bile, saliva, autoclaved intestinal mucus and tissue cultures. The following substances inhibit it under certain conditions: pus, urine, ascitic fluid and cerebrospinal fluid. In spite of these substances which inhibit lysis, however, the lytic principle may have a beneficial action in other ways. MacNeal and MacRae (1937) have recently verified earlier findings that the bacteriophage specifically enhances phagocytosis. Other indirect effects of which we have no knowledge at present may also take place.

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fluids except normal urine, cerebrospinal fluid and sweat. In purulent urine, the amount present is proportional to the amount of pus. Human tears and saliva have a very high lysozyme content and its presence in human milk may be a factor in controlling infection in the newborn. Cats have a very low lysozyme content and the enzyme is apparently absent altogether in goats. Lysozyme has been found in a variety of plant tissues, and certain bacteria may produce it.

Like the bacteriophage, lysozyme acts on a wide variety of bacteria. Certain air-borne cocci seem to be more susceptible than other forms. The organism originally isolated by Fleming, which he named *Micrococcus lysodeikticus,* is very sensitive to lysozyme. Most of the common bacteria pathogens have been found sensitive to the enzyme.

Lysozyme may have several functions in any organism in which it is found. It is probably one of the factors in the establishment of normal flora. Thus, Rosenthal and Lieberman (1931) have indicated that the normal intestinal flora of the infant is determined, in part at least, by the lysozymatic properties of the mother's milk. Lysozyme may also prevent infection. Arnold (1928) has shown that when large numbers of pathogens are spread on the skin or sprayed into the nasal cavities, they completely disappear in a relatively short time. Ridley (1928) has shown that high concentrations of tears not only inhibit growth but actually kill large numbers of staphylococci, streptococci and pneumococci. Thus, it appears that lysozyme may serve as an effective prophylactic agent.

Lysozyme may play an important rôle in phagocytosis. Bradford and Roberts (1937) believe that the quantity of lysozyme in the serum parallels the leukocyte count. Fleming (1932) points out that although lysozyme-resistant bacteria may be phagocytized, only those which are sensitive to the lytic agent are digested intracellularly. It would be interesting to know whether such lysozyme-digested bacterial cells act as vaccines after the disintegration of the phagocyte.

Several criteria of lysozyme activity have been generally accepted, but, by definition, lysis is the only valid one. The bacteriostatic and bactericidal effects cannot be considered due to the action of lysozyme unless such effects are accompanied by dissolution of the bacteria. The supposed production of the lytic enzyme by the colon bacillus, as reported by Goldsworthy and Florey (1930), is more likely due to the antiseptic action of the indole produced by this organism. However, these workers do not claim to have established the lysis of their test organism and admit that the mechanism of the inhibition is not known. Bibby (1938) found inhibiting factors in saliva which do not lyse the test organisms and so must not be confused with the lytic principle. In spite of this outstanding difference between antiseptic or germicidal agents and lysozymes, workers have glibly attributed any antibacterial activity in saliva to lysozyme.

It should also be pointed out that there is not necessarily just one lysozyme. It is quite probable that this enzyme varies with its source and that different lysozymes might act on quite different organisms in much the same manner that different strains of bacteriophage act on different hosts.

As early as 1891, Sanarelli noted that filtered saliva exerted a definite lethal action against various cocci, the typhoid bacillus and the cholera vibrio. When cultured in saliva, the pneumococcus was attenuated. In 1909, Barnes reported similar findings. Gordon (1916) showed that saliva had a definite antibacterial action against the meningococcus. He also found that heating or filtering the saliva apparently destroyed or removed the antibacterial agent. Employing a variety of bacterial types, Bloomfield (1919,

1920) failed to obtain any bacteriolytic effect except with *Sarcina lutea*. McIntosh and his co-workers (1925) failed to demonstrate any bactericidal action of saliva against *Lactobacillus acidophilus*. Bézi (1932) noted that some specimens of saliva exert an antibacterial action against the diphtheria bacillus. Kopeloff (1932) found that the saliva of normal persons and of postencephalitic patients would lyse Fleming's coccus. Clough (1934) studied the antibacterial properties, against a variety of organisms, of saliva from a number of individuals. He found no inhibition of the colon bacillus in the presence of saliva, but a wide variety of other bacteria were definitely inhibited. Fresh saliva from a number of individuals (195 out of 204) was inhibitory toward *Lactobacillus acidophilus*, but no lysis of this organism was demonstrable. In children, there seemed to be no correlation between the degree of bacteriostasis and the dental condition.

Similar findings are reported regarding the nasal secretions. In 1901, Schousboe concluded that the nasal cavity was normally sterile or nearly so because of the antibacterial properties of the nasal secretion. He further showed that a variety of bacterial species are rapidly killed by the nasal secretions. Arnold (1928) noted a killing in from five to ten minutes of from 90 to 95 per cent of the bacteria placed on the mucous membranes of the nose. He failed to obtain such results, however, in test-tube experiments.

Goldsworthy and Florey (1930) studied the mucus of various parts of the body as well as tears and saliva. They found different animal species to vary in the location and amounts of lysozyme. Corper (1932) tested extracts of various guinea-pig tissues, which were supposed to contain large amounts of lysozyme, against the tubercle bacillus, but could demonstrate no antibacterial properties in them.

From these reports, it is evident that the rôle of lysozyme in infection is not known and very little work has been done to indicate whether its presence is associated with susceptibility or degree of infection. Although found in the pleural exudate of tuberculous individuals (Pinner, 1937), there is no evidence that it alters the course of the disease. Clough (1934) could find no correlation between the presence of lysozyme in saliva and the dental condition of children, but it does not necessarily follow that the lysozyme content of the saliva is independent of infection. Ridley (1928) noted a drop in the lysozyme titer of tears when a foreign body was introduced into the eye or when infection was present. This decreased lytic activity could be explained on the basis of dilution due to excessive lachrymal secretion.

In conclusion, it can be said only that the relation of the bacteriophage and lysozyme to oral infection is not known. Until clinicians are willing to take the pains to study these problems carefully on a statistical basis, the subject will remain in darkness. It is necessary to emphasize that almost all of the clinical data now available are worthless, but this does not mean that these lytic agents may not eventually prove to be useful in combating certain types of infections.

BACTERIOLOGIC TESTS FOR ROOT-CANAL STERILITY

By Morton F. Yates, D.M.D., and Fred W. Morse, Jr., M.D., Boston, Mass.

IN the light of modern scientific research, root-canal therapy can be attempted only under conditions of strict asepsis and when the progress of treatment is bacteriologically checked.

The old method of determining the condition of the canal by the absence of odor or moisture can no longer be deemed adequate, in view of our present knowledge of biologic processes.

Most practitioners have failed to make use of this scientific control of treatment mainly because of the supposed expense involved. It is generally believed that this procedure requires an elaborate equipment plus medical training to interpret the findings. This is not the case, for already many modern dental offices are depending on bacteriologic controls in all root-canal cases and are finding that such a procedure does not require expensive equipment or involve complicated tests.

Let us first consider the clinical requirements for carrying out the technic, and later the equipment for incubation and the culture material needed.

The first and most important requirement is that all operations be carried on under strict asepsis, as otherwise the bacteriologic findings have no meaning whatever. This requires, first, a sterile field of operation; that is, a field painted with tincture of iodine, with the rubber dam in position.

All instruments to be used should be freshly sterilized and kept aseptic by being placed in a tray containing 70 per cent alcohol or some other suitable sterilizing solution. A sterile pan should be provided, of white enamel, possibly 4 by 5 by 2 inches, and containing cotton pledgets, J & J paper points, sterile gauze, cotton rolls, short pieces of orthodontic wire 26-gage, about 1 or 2 inches long, to be used as diagnostic wires for measurement of the canal, and two dental towels. The pan should be wrapped in a piece of sheeting and fastened with pins. These pans may be prepared in the office, several at a time, and, if it is convenient, can be sent to a near-by hospital for autoclaving.

The sterilization of the pans can be done in the office by using an ordinary pressure cooker with a pressure gage. Twenty pounds pressure maintained for from fifteen to twenty minutes is sufficient. The pans may be baked in a gas or electric range oven at 160° C. (or 320° F.) for one hour and a half. All modern gas and electric ovens are equipped with thermostats, which will maintain any desired temperature. These pans, if properly wrapped after sterilization, may be kept in the office for some time without danger of contamination.

ASEPTIC TECHNIC

With the rubber dam in position and the field painted with tincture of iodine, the pins holding the covering of the sterile pan are carefully removed.

With cotton pliers, the tines of which have been flamed by dipping in 95 per cent alcohol and then burning off the alcohol by passing them through the

From the Harvard Dental School.

flame of an alcohol lamp, a sterile towel is removed and placed over the bracket table.

On this sterile towel, there should be placed, in a convenient position, the sterile pan and an alcohol sterilizer with three wells, the center well containing 95 per cent alcohol for flaming instruments and the two outer wells 70 per cent alcohol for holding picks, broaches, files, reamers and any other root-canal instruments needed; and a white enamel pan 8 by 3 by 2 inches, containing 70 per cent alcohol, for holding mirrors, cotton pliers, burs, plastic instruments, explorers, gutta-percha instruments, etc. An alcohol lamp or its equivalent should also be available.

Before any supplies are taken from the sterile pan, the tines of the cotton pliers should be dipped in 95 per cent alcohol and passed through the flame. This will prevent contamination of the materials in the sterile pan.

The tooth requiring treatment is opened with a sterile bur, and a direct full view of the pulp chamber and canals obtained.

BACTERIOLOGIC CHECK-UP

The tines of the cotton pliers are flamed, and a sterile J & J paper point is taken from the sterile pan and placed in the canal to be checked; or the point placed in the canal at the last visit of the patient may be used.

Each culture tube should be labeled, with the patient's name, number of tooth, the date, etc.

The cotton plug in the culture tube is now flamed and removed. The neck of the tube is flamed and the paper point from the canal is dropped into the tube. The neck of the culture tube is reflamed and the cotton plug replaced. The paper point must be immersed in the culture medium.

The tube or tubes are now incubated at 37.5° C. for from forty-eight to seventy-two hours. The broth before incubation should be clear. If, after sufficient incubation, the broth appears cloudy, bacterial growth is present.

It is not necessary to make further studies to determine the presence or absence of organisms. If, however, further studies are desired, smears may be made from the cloudy broth, stained by Gram's method and examined with the oil immersion objective for the type of organism present. Blood-agar plants may also be made for a more detailed study of organisms.

Such a method of bacteriologic check-up eliminates the element of chance and raises the standard of root-canal therapy to that of a modern scientific procedure. It also improves the prognosis of the case by giving accurate information on which to determine what the next step in treatment should be.

After two consecutive negative bacteriologic check-ups have been made, and other conditions have been fulfilled, the canal or canals are ready to be filled.

Failure to secure negative results contra-indicates further root-canal treatment.

THE INCUBATOR

An expensive thermostatically controlled incubator is desirable, but not necessary. A metal or even an insulated wooden box 10 by 12 by 10 inches with a tight fitting door and possibly two removable shelves, the insertion of which permits reduction of the size of the box, makes a satisfactory substitute. An ordinary oil stove type of metal oven can be adapted very well for use as an incubator. There should be two holes in the top of the box, one to admit an electric wire from which to suspend a lamp in the box, the other to permit placing a thermometer in a position to be read from the outside of the box.

By some experimentation with electric bulbs of different sizes, we can find the one which, with the temperature of the

room fairly constant, will maintain the proper temperature within the box, i.e., 37.5° C., with little or no variation. Such an incubator is employed in the clinical laboratory at the dental school, and we find the temperature in the box can be kept uniformly constant by the use of a 25-watt lamp.

With the matter of routine incubation solved in this way, there remains the problem of having the proper sterile media in tubes of suitable size so that they can be economically incubated and easily handled at the chair-side. The medium which we have found reasonably successful and at the same time easy to prepare is a 1 per cent dextrose infusion broth made up at the laboratory of the bacteriology department of the Harvard Medical School.

To help the bacteriologist whom you might consult in your community to select a medium or to prepare a medium especially for your needs, the method of preparation is described.

TECHNIC

For the infusion, steep 400 gm. of fat-free minced beef heart in 1 liter of cold tap water overnight in the ice box. Cook over a free flame, boiling from ten to fifteen minutes. Strain through a wire sieve and adjust the desired pH with tenth normal sodium hydroxide. Then boil thirty minutes over the free flame. Filter hot through paper. Flask in 500 cc. amounts and autoclave at 15 pounds for twenty minutes. To have a final pH of 7.6, 22 cc. of tenth normal sodium hydroxide was added as described above, and the dextrose (1 per cent) added just before placing in the tubes that are to be used for the diagnostic procedure.

From our standpoint, that of showing the presence or absence of organisms on a routine basis, this medium has proved satisfactory. For research work, the brain broth of Rosenow or the glucose-ascites medium of the University of Michigan dental school might be more suitable.

One of the first places to look for help in this matter of media is the local board of health bacteriologic laboratory, or the laboratory of a local hospital. The broth medium or a 1 per cent agar which is used for the growth of streptococcus or pneumococcus would be a reasonable medium to try in root canal cases. This medium will probably be more easily handled if it is tubed in small Wassermann tubes, 3 inch by three-eighths inch test tubes. Small tubes of this size are easier to handle at the chairside and take up less room in the incubator. The laboratory should supply the tubes already sterilized and ready for use.

The tubes should be kept where they will not gather dirt, and preferably in a cool place, such as an ice box. The latter provision is primarily to reduce evaporation, with a consequent change in the reaction of the medium. If one is using the tubes fairly frequently so that they will not become too old before using, they will be satisfactory if kept at room temperature.

Of course, it is possible to prepare bacteriologic media in one's office, but a busy dentist should not take time for it unless it is distinctly a phase of a hobby. It is simply a matter of cooking, but it requires several ingredients which must be carefully weighed out, and it requires more time than a dentist or even his assistant should take.

If there is no board of health or hospital laboratory available which can supply the medium conveniently, there is another solution to the problem. One can buy media all ready to use, put up in tubes with screw caps and furnished with extra sterile cotton plugs. Using the same precautions for handling the tubes as with the media prepared locally, the practitioner has only to arrange for incubation, and return the used tubes to the producer when he orders a fresh supply.

Media can be bought in bulk and the tubes filled and sterilized at the office.

This would be a less expensive method, as is likewise the other plan by which the media can be purchased dry and weighed out, dissolved in water and then put in small tubes and sterilized. The sterilization will require 10 pounds pressure for fifteen minutes in the autoclave or pressure cooker.

Incubation at 37.5° C. (98.6° F.) should be carried on for seventy-two hours, if nothing appears to be growing in less time. Usually, growth will occur in the first twenty-four hours, but 10 per cent or more of the cultures will not show the development of organisms for from forty-eight to seventy-two hours, so that for reasonable accuracy this longer period of incubation must be allowed.

It is rare that, with a positive tube, there will be such slight growth as to offer any difficulty in reading the results. The cloudiness is definite. After the tubes have been observed and the results recorded, the tubes should be boiled to prevent danger of contamination of oneself or the office from the organisms which may have grown in the tubes.

Such a method of checking the progress of root-canal cases by bacteriologic tests is reliable, scientific and practical, and its adoption will do much to raise the standards of treatment for this type of case. That it is workable and practical has been proved beyond question and the greater confidence it gives fully justifies its use.

USE OF MUSCLE EXERCISE IN ORTHODONTIC PRACTICE*

By Asa J. LaGrow, D.D.S., Oak Park, Ill.

THE use of muscle exercises in orthodontia is to be considered briefly as a therapeutic agent for the prevention and correction of malocclusion and as an agent in maintaining occlusion through the improvement of function.

In a paper entitled "Function and Retention," Harold J. Noyes[1] writes:

The particular occlusion of an individual is a result of: 1. The hereditary pattern or potentiality in growth and development of that individual. 2. The systemic factors which influence the character, formation and function of the body mechanism. 3. The skeletal structural elements including teeth, bone and joints. 4. The soft tissue comprising muscular, vascular, nervous and connective tissue with important accessory stroma and fluids. 5. The interaction of these factors in function. 6. Their response to external stimuli, particularly disease and external pressures. These are very complex and highly synchronized features which in their interaction cannot be easily differentiated. Function with respect to dental organs is concerned essentially with performance and is influenced by all of these factors.

The scientific workers in the orthodontic field are not in entire accord as to the value of muscle exercise or myofunctional treatment. In an epoch-making contribution on the mechanism of growth of the human face, Keith and Campion[2] produced evidence that the mechanism is influenced by the functional state of the pituitary and the gonads. They conclude, however, with:

Modern dietary is of a kind which leaves teeth, jaws and muscles of mastication imperfectly exercised. The physical stimuli

*Presented to the American Board of Orthodontia.

which are necessary for the normal growth of bone are missing. This, too, may be a factor in gnathic degeneration.

Here is, at least, a hint that increased function is of value in the orthodontic problem.

Howard,[3] in an article entitled "Inherent Growth and Its Influence on Malocclusion," states: "For example, examine the literature on 'muscle training' and its influence on jaw and arch growth, and find, if you can, a single bit of evidence wherein this procedure has been proved to be of value." He concludes: "The foregoing was cited not for the purpose of condemning the practice of muscle exercise nor to discourage its advocates, but only to suggest that their deductions fail completely to prove a scientific fact." It is rather apparent, however, that Howard recognizes physiologic function as the second phase of development, for, in the same article, in discussing growth and development, he writes:

Fig. 1.—Patient performing lip depressor exercise.

Development offers two biologic manifestations: embryologic differentiation and physiologic function through use (perfection of function). . . . Perfection of function . . . conveys a meaning allied with action. Muscular contraction and relaxation in mastication is a developmental expression of "perfection of function." In short, "perfection of function" as a phase of development, is inseparable from action.

In muscle exercises, we attempt to give the patient increased physiologic function through increased use of muscles in those cases wherein the musculature is poorly developed and function is feeble and perverted.

Brash,[4] in discussing variations on a genetic basis, says, "It is clearly reasonable on general principles to consider environment—including in the most general sense of the word all individual factors external and internal—as the complement of the genetic constitution." In myofunctional therapy, we impose functional factors to assist the growth mechanism in developing the inherent pattern. In my opinion, function has a definite relation to the fundamental problems of malocclusion of the teeth.

Hellman[5] writes:

The major part of treatment must . . . depend upon the knowledge of those conditions which are included in the general phenomena of life. One of the most important of these is development. The development of an organism is effected by growth and differentiation. The average patient requiring orthodontic treatment is usually in the most significant developmental period of life. The jaw bones at that time are going through the stages of growth preparatory to or simultaneous with the differentiation of the dentition. The treatment of a case of malocclusion is therefore closely related to the increase in complexity of the dentition and to the increase in size of the jaw bones.

The teeth are units of an anatomic mechanism through which functional forces influence growth and development. It is the aim of the orthodontist to maintain a normal relation of the dentures in harmony with the cranial and facial structure and, when it is indicated, to

correct the position of the denture units and the position of the dentures as regards the cranial structure so that these functional forces can be maintained. We are therefore dealing with vital processes of development the very purpose of which is function. Function is an expression of life. In normal individuals, function is vigorous from birth. It is usually the physically subnormal child who is brought to the orthodontist. There is often a growth-retarding factor present, such as an allergy.[6] In many of these children, the functional activity of the muscles is habitually and inherently feeble, while certain groups of muscles are found to have abnormal function (over-function) or abnormal tonicity.

The cooperation of the pediatrician and the rhinologist should be sought by the orthodontist in all cases in which a growth-retarding factor is present.

The use of muscle exercises in orthodontic practice has been fully covered by Alfred Paul Rogers[7] in many papers, the first of which, to my knowledge, appeared in 1918 and was entitled "Exercises for the Development of the Muscles of the Face, with a View to Increasing Their Functional Activity." The subject has been so well developed by Rogers that there is no real need for further elaboration of it except to give additional evidence that the principles are biologically and practically sound. The following quotation from this paper,[7] which appeared in italics, reveals the key points to Roger's philosophy:

Fig. 2.—Severe Class II malocclusion before treatment.

The orthodontist has handicapped himself in the past by trying to gain results solely through his own efforts instead of pointing the way to personal self-improvement by the patient, ignoring the physiological forces which work under the direction of the mind in stimulating functional activity of the various organs which are essential to his complete success. . . . We have allowed ourselves to become baffled by the weakness of development to attain a form capable of function. In point number five of the first paragraph, the interaction in function of all the factors named in the first four points is stressed. To gain the correct concept of this requires much clear thinking. The words of Henry Van Dyke "To think, without confusion, clearly" apply here with much force.

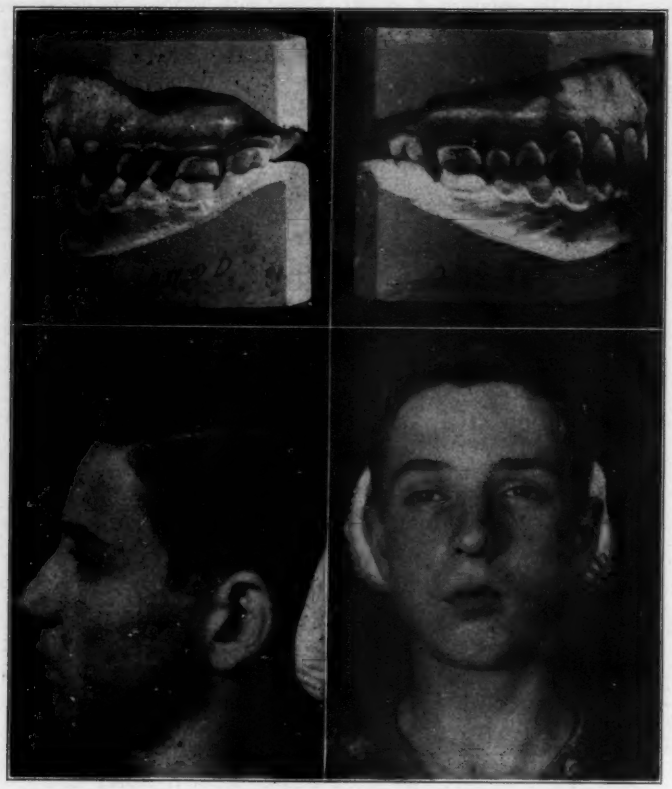

Fig. 3.—Patient shown in Figure 2, five years after retention was completed.

unused or improperly used forces of the soft tissues of the face.

It is very apparent that the emphasis is on improvement of function. In all of the subsequent papers written by Rogers, the same theme is developed. All orthodontic treatment is directed toward assisting the natural forces of growth and

The growth and development of the mandible is hastened by function immediately after birth. Wallace[8] found that the mandible in the new-born is usually in posterior relation to the maxillae and that it develops in a forward direction through function in grasping the nipple. Growth is very active at this

period and very responsive to trophic stimuli. Because of the growth activity initiated by this instinctive exercise, the mandible soon lengthens, so that the anteroposterior relationship of the jaws is normal before the eruption of the deciduous incisors. Thus we see that Nature uses a muscle exercise very early in life to assist in developing the mandible. In those cases, however, wherein this instinctive exercise is subverted, the posterior position of the mandible persists and becomes apparent when the deciduous cuspids and molars erupt. Nature uses another instinctive exercise, which begins shortly before the eruption of the deciduous incisors. This is the instinct to gnaw. The gnawing is done entirely on the gum pads in the incisor region and later with the incisor teeth themselves during eruption.

As pointed out by Wallace,[8] the greatest strain on the jaw is caused by biting on the front teeth. The temporal, masseter and internal pterygoid muscles exert a trophic stimulus and induce growth of bone at the angle of the mandible to resist strain imposed by the action of these muscles. In the further development of the jaws, Nature employs the muscles of mastication to cause wear and attrition of the deciduous incisors and cuspids so that the mandible can move forward, an incisal edge to incisal edge relation of the deciduous incisors resulting. This, when it occurs normally, favors eruption of the mandibular first permanent molar before eruption of the maxillary first permanent molar. However, when the attrition does not take place, the overbite of the incisors persists, the mandibular teeth and the mandible

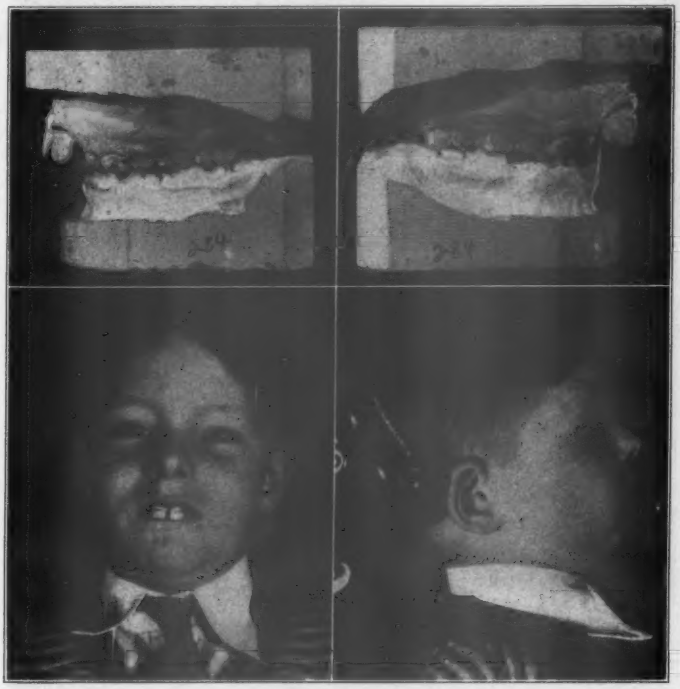

Fig. 4.—Severe Class II malocclusion before treatment.

may be held back and the maxillary teeth may move forward as the maxillary first permanent molar erupts, because of deficient growth posteriorly. There is thus the beginning of a Class II relation of the dental arches. It is thus part of Nature's plan to bring about development of the jaws and dental arches through function of the muscles of mastication.

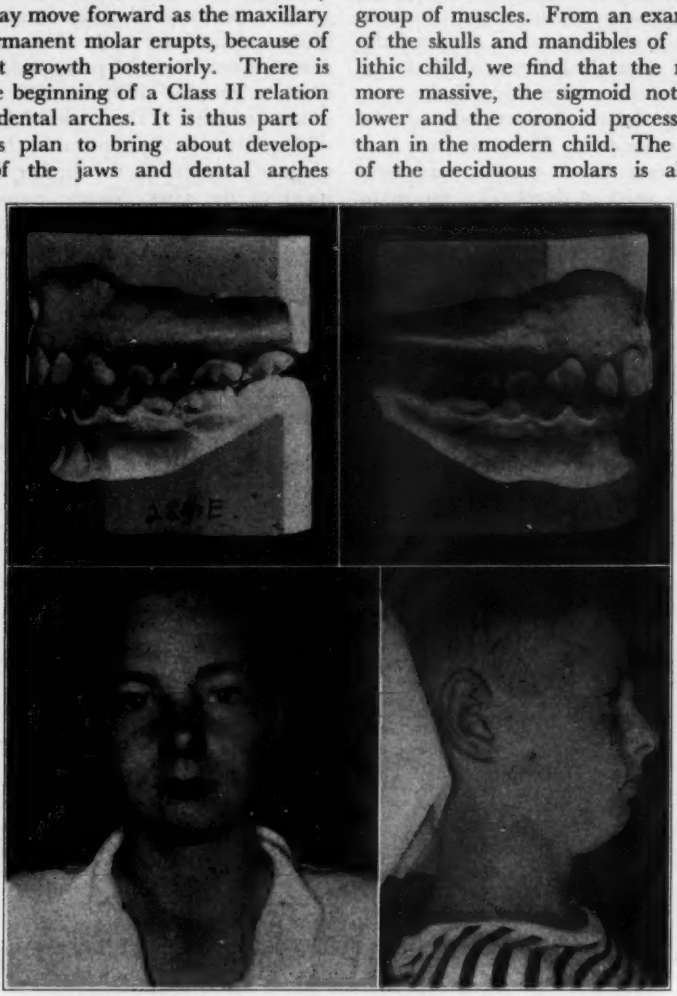

Fig. 5.—Casts and photographs of patient shown in Figure 4, six years after completion of retention.

Nature is purposeful in the manner in which tissue formation and design evolve, and dental occlusion is developed by the activity of definite and harmonious forces. One of these forces is the musculature in action, which includes both the muscles of mastication and the facial group of muscles. From an examination of the skulls and mandibles of the neolithic child, we find that the ramus is more massive, the sigmoid notch shallower and the coronoid process heavier than in the modern child. The attrition of the deciduous molars is also very marked, indicating that function was much greater than in the modern child. In the modern man, however, the well-developed angle of the mandible denotes function, as can be ascertained by examination of the masseter muscle.

The change that takes place in the bones giving origin to the masseter

muscle from the age of 2 to 20 years further demonstrates the rôle of function in development.[8] As the pressure strain on these bones increases, bone is deposited on the external surface of the malar processes of the maxillae, on the malar processes of the temporal bones and on the malar bones. With the progressive eruption of the maxillary molars, the pressure strain produced during mastication is transferred farther back. Simultaneously with these changes, the malar processes and malar bones shift backward and outward. These changes in structure, with the exception of the eruption of the teeth, have been brought about partly through muscle function, which is one of the forces in the production of normal occlusion of the teeth. When this developmental process is complete, the bony structure that gives attachment to the muscles of mastication is found to be well supported against the stresses of mastication by the jugal or malar processes. The maxillae are supported by the malar bones and, through them, by the great wings of the sphenoid, the frontal bone and malar processes of the temporal bones. The frontal bone gives support directly, as the maxilla articulates with the nasal bones and frontal bone by means of the frontal processes.

Fig. 6.—Severe Class II malocclusion before treatment.

An important function of a group of muscles in supporting the posterior ends of the maxillary dental arch has been stressed by Strang.[9] Muscular pressure is exerted against the maxillary molars

by the buccinator, masseter and internal pterygoid muscles, preventing posterior displacement of the maxillary arch ends.

It is through the occlusion of the teeth that the muscles of mastication cause pressure, which assists in molding the denture toward perfection of form or toward abnormality. When one or more of the denture units are displaced, the balance of all the various forces is disturbed and a deformity eventually develops. The muscles on both sides are also unbalanced. First, the denture units must be corrected, usually with the assistance of a mechanical appliance, and then the muscles must be re-educated, so that function will be normal and the recurrence of the deformity will be prevented.

The muscles of mastication are composed of two groups. The first group, which closes the jaw, includes the masseter,[10] which, in closing the jaw, draws the mandible forward slightly and, when acting on one side, deviates to the opposite side. The internal pterygoid closes the mandible and exerts a bilateral forward pull, and, when acting on one side deviates to the opposite side. The temporal closes the jaw and exerts a backward pull, and, when acting on one side, deviates to the acting side. The second

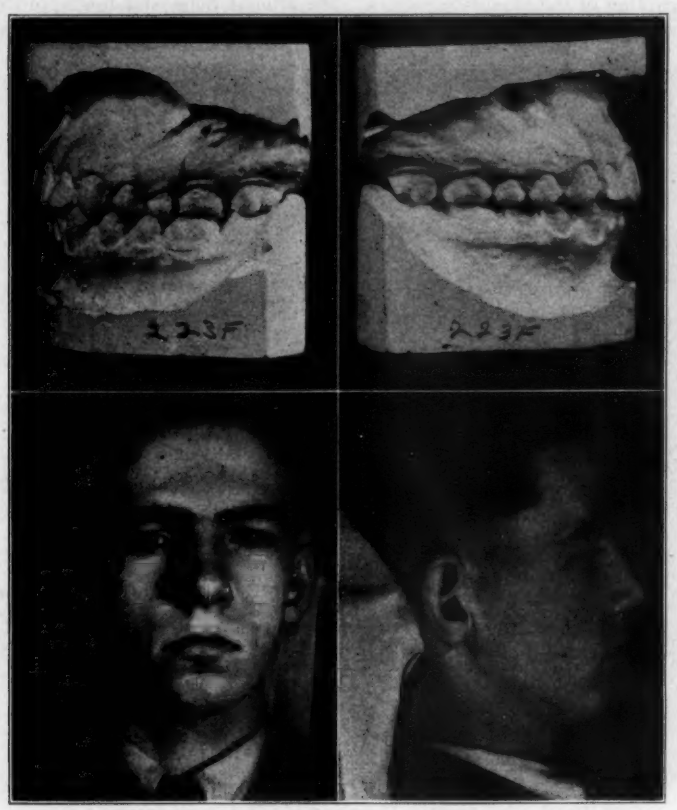

Fig. 7.—Patient shown in Figure 6, six years after completion of retention.

group, which has the opposite function, that of opening the jaw, includes (1) the external pterygoid, the lower head of which carries the condyles and the articular disk forward and downward onto the eminentia articularis (while the posterior fibers of the temporal muscle relax) and, when acting on one side, deviates to the opposite side; (2) the mylohyoid; (3) the geniohyoid, and (4) the anterior belly of the digastric. The last three muscles named cause the mandible to rotate around the transverse axes of the condyles and depress the mandible. At the same time, their opposing muscles, the masseter, the internal pterygoid and the temporal muscles, relax completely. The three muscles named, which depress the mandible, have another function. When the mandible is closed, they draw the hyoid bone forward and upward. Closely associated with these muscles are three muscles of the tongue, the styloglossus, the hyoglossus and the genioglossus. These structures are supported posteriorly at the styloid process of the temporal bone by the stylohyoid, styloglossus and stylopharyngeus muscles.

The load carried by the mandible,[11] however, is considerable in view of the great muscular activity of this region. When the mandibular teeth are completely locked against the maxillary teeth, this load is shared by the maxillae. In many extreme Class II cases, however, in which the patients are mouth-breathers, the mandible closes very slightly and thus carries this load without anterior support, which discourages a normal forward positioning of the mandible. Patients with this affliction appear lackadaisical and indifferent and usually have a poor posture, indicating a general condition of deficient muscle tone. I have in mind the type of case that James D. McCoy diagnoses as mandibular retroversion. To emphasize the magnitude of the problem that these cases present, McCoy told the American Society of Orthodontists that when we undertake to treat these patients "we take a child to raise."

Fig. 8.—Class II, subdivision, malocclusion.

A critical study of the suprahyoid group of muscles in this type of patient makes it clear why this is true. The drag of this load is so great that the mandible is in a posterior position during mastication, swallowing and talking, and remains so in many cases, even after con-

scientious and careful treatment with appliances and intermaxillary elastics.

In the anthropoid apes, the head hangs forward, which lessens the drag on the mandible from the suprahyoid group of muscles. The upright posture increases the load on the mandible, and, when the mandible itself is deficient, this load increases the difficulty of correction. Training in muscle exercises offers the greatest improvement for these patients, in conjunction with proper orthodontic treatment. The muscles which should be strengthened for this condition are the masseters, internal pterygoids, external pterygoids and temporal muscles. These are the muscles which oppose the suprahyoid group of muscles.

Fig. 9.—Photograph of patient shown in Figure 8, after completion of mechanical treatment. Further work on the facial muscles is indicated.

Friel,[12] in his "Investigation into the Relation of Function and Form," emphasizes the important point in muscle physiology that the strength and tone of a muscle depend not only on the contraction of that muscle but also on the strength of its opposing muscle. An example of this is the contraction of the lower head of the external pterygoid when the mouth opens and the relaxation of its opposing muscle, the posterior fibers of the temporal muscle. Friel's work was done with various dynamometers, and, in this investigation, he assumed that the maximum strength of a muscle group is indicative of its functional capacity. He found that general muscular weakness is nearly always associated with underdevelopment of the jaws, but not with any particular class of malocclusion. His opinion was that both the poor development of the musculature and the osseous condition were symptomatic of some general maldevelopment. When muscular strength was marked, well-developed jaws were the rule, although perfect alinement of teeth was not.

In the practice of orthodontics, we can apply some of the principles that are used by Nature to develop the jaws and normal occlusion. In nearly all orthodontic patients who require myofunctional therapy, there is muscular inertia, with the muscles undersized because of lack of function. There is usually also poor coordination.

To make myofunctional therapy effective, the orthodontist must have an intimate knowledge of the requirements of the case at hand. A thorough case history must be had to obtain a knowledge of the patient's background. The case analysis must be thorough and complete, covering the condition of the muscles of mastication, including the suprahyoid group of muscles; posture; tongue position; the act of swallowing, and the condition of the lips and associated musculature, including the mentalis muscles, as to whether they are hypotonic, hypertonic, underactive, overactive or normal. Are the lips parted when the jaws are at ease? The patient is asked to close the lips and is observed closely. Does the upper lip actively participate in the act of closing? Does it remain passive and allow the mentalis muscles to push the lower lip up until closing is effected? Habits which are perversions of normal functional processes should, of course, be recorded.

It may be well at this juncture to consider the terms hypotonus, hypertonus, overactive and underactive. Hypotonus is usually associated with lack of function and control, as seen in the short upper lip. It also occurs in the lower lip, which usually becomes infiltrated with fat and greatly thickened, as seen in many mouth-breathers. Hypotonus is a condition of a muscle in which there is a diminution of tonicity. Hypertonus is the opposite of this condition; i.e., the muscle exhibits extreme tension. This condition is often seen in the mentalis muscle, where, in some cases, the tension is very great and the muscle feels unyielding to the finger. The terms hypotonus and underactive indicate nearly the same condition. The term overactive

Fig. 10.—Class II with deep overbite.

Fig. 11.—Casts of case shown in Figure 10, two years after completion of retention.

means that a muscle or an organ exerts greater and more frequent pressure than normal and to an extent to cause imbalance in the adjacent structures. This is seen in the tongue, and in the mentalis muscles.

On the subject of muscle tone, Kirke's "Physiology"[13] states that "the probability is that tone is a reflex activity, though it may be contributed to by the normal healthy nutritional condition of the muscles themselves—a condition which is itself dependent on the trophic influence of the nerve cells of the cord and brain stem."

I again quote from a paper by Rogers,[14] entitled "Increased Function in the Treatment of Dental Anomalies."

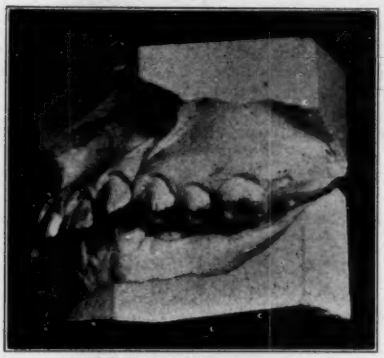

Fig. 12.—Class II, Division 1, case with extreme crossbite on left side.

Fig. 13.—Cast of case shown in Figure 12, four years after completion of retention.

In focusing our attention upon that part of the anatomy with which we are chiefly concerned, we arrive at the conclusion that, if from the beginning we are able to establish and maintain normal function, we are taking one important step toward the continuance of satisfactory growth. We do not forget, of course, that in some instances even increased function of the part under our immediate attention may fail to bring response because of a fault in function somewhere else in the organism, perhaps something that may be beyond our present-day professional skill. Even in such an instance we are comforted by the thought we have at least used those natural forces which are at our disposal. Only in that day when the biologist is able to understand minutely the processes of growth and development and has gained the ability to direct them more intelligently, shall we be free from the necessity of continuous efforts either through deliberately increasing function, or by the application of mechanical apparatus designed to stimulate growth.

The muscles which form the facial musculature have been referred to as limiting any backward movement of the denture. One of these muscles is the buccinator. Its origin is from the upper and lower alveolar processes, above the molar teeth in the maxillae, and below the molar teeth in the mandible, and also from the pterygomandibular ligament. It is inserted in the muscle mass which forms the angle of the mouth and which Friel[12] calls the modioli. It has a double action. It draws the angle of the mouth backward, and, when the muscles forming the angle are fixed, its fibers contract and press the mucous membrane of the cheek against the lateral segments of the denture.

The condition of the lips and their associated musculature is very important to the orthodontist. When their function is normal, they limit the forward movement of the incisor teeth. Their functional derangement must be recognized by the orthodontist and measures must

be adopted to correct the condition. These derangements can be described as hypotonicity, underfunctioning, hypertonicity and overfunctioning. Hypertonicity can be thought of as a derangement in static function. Friel[12] describes static function as the position of the parts at rest, brought about by an equilibrium of the tonic forces of contraction. A derangement of static function is a very positive force in producing malocclusion. The attention of the orthodontic profession was called to this important subject by Angle[15] in 1911 in a paper entitled "Habits," and also by Lourie[16] in a presentation entitled "Some Abnormal Functions Associated with Malocclusion." The usual closure of the lips is in a vertical direction with the teeth closed. This is normally performed, when the muscles forming the angle of the mouth are fixed, by the contraction of the orbicularis and the mentalis muscle.

The fixation of the muscles forming the angle of the mouth is brought about by the contraction of the buccinator, risorius, caninus, zygomaticus and triangularis. The functional derangement of the mentalis is very common. It is usually associated with deficient function of the upper lip and a prominence of the lower lip, with poor tone. In attempting to close the lips, the patient contracts the mentalis muscle only. In many of these cases, the mentalis is continuously in a state of hypertonicity. The abnormal pressure thus produced against the lower cuspid and incisor teeth produces an imbalance of forces, and a fault in arch continuity is the result.

A variety of corrective exercises have been recommended for this condition.

Fig. 14.—Class I malocclusion, short upper lip and overactive mentalis muscles.

The object of all those thus far recommended is to restore tone to the orbicularis oris muscle. Lourie has pointed out the necessity of discouraging the overactivity of the mentalis. The exercise that I have been using restores tone to the orbicularis oris and at the same time counteracts the contraction of the mentalis. I have called it the depressor lip exercise because it is the depressor muscles of the lips that are activated in this exercise. The muscles which are activated in this exercise are the orbicularis oris, the platysma, the quadra-

tus labii inferioris and the triangularis.

The origin of the triangularis is a short section of the mandible just above the lower border and below the mental foramen. Its fibers converge into the angle of the mouth and curve into the upper lip. Its normal action is to draw the angle of the mouth downward and, the two sides acting together, draw the upper lip down. In this, it is assisted by the platysma. The triangularis is the dominant muscle in this exercise. To perform this exercise, the teeth and lips are tightly closed and the depressor muscles are contracted. This brings both lips downward together and the orbicularis oris contracts at the same time. The mentalis muscles are compelled to inactivity during the time the exercise is being done and are overpowered. When this exercise is carried out with regularity, the lips finally close normally without any abnormal activity of the mentalis muscles. It is highly important, however, for the orthodontist to understand this exercise thoroughly before attempting to teach it to the patient.

Figure 1 shows the patient performing the exercise, and it will be noted that the mentalis region is smooth, this indicating that these muscles are not contracting. Patients with a Class II condition should be taught to close the teeth together while performing the exercise because, when they are not closed, contraction of the platysma muscle pulls the mandible backward.

Exercises for the other groups of muscles, described by both Rogers and Lourie, have proved very satisfactory. The various segments of the denture must be placed in a position where function is possible before corrective exercises are used, with the exception of the depressor exercise which has been described. In many Class II cases, the entire upper denture must be moved or tipped distally before exercises are attempted.

Fig. 15.—Patient shown in Figure 14, with improved lip condition.

The procedure will, of course, depend on the case analysis.

In order that functional forces may influence growth, the various parts of the denture must first be placed in balance to one another and to the cranial structures. The axial positions of the teeth must be as favorable as it is possible to make them. In my opinion, the orthodontist is justified in tipping the upper denture distally in many Class II cases so that a mechanical advantage can be gained before the functional forces are expected to be a factor in the correction. According to the conclusions of both Oppenheim[17] and Hellman,[18] the upper

denture is not too far forward in relation to the cranium and face in Class II cases of malocclusion. The anomaly is in the mandible. Nevertheless, we are justified in tipping the upper teeth distally so that the functional forces can become effective.

It is exactly on this point that many men have become discouraged with muscle exercises. Their experience has been unfortunate. I believe that I know what has happened in those cases. The patient carried out Rogers' temporal-mandibular exercise and, while in the orthodontist's presence, held the mandible forward. In speaking and swallowing and during mastication, the mandible is in a posterior position. The function was never corrected. Finally, the patient lets the mandible drop back altogether, especially after discontinuing the exercise. When the upper teeth are tipped back at the beginning of treatment, both the period of active treatment and the period of retentive treatment are greatly shortened. In carrying out this procedure, some form of stationary anchorage should be used on the lower teeth.

There are a few patients with mixed dentures for whom a Class II condition can be definitely corrected without the use of intermaxillary force. The success of this procedure, however, is usually limited to a small group of cases. After the upper teeth have been tipped distally, the form of the dental arches should be checked. All tooth rotations should be slightly overcorrected. Special attention should be given to the correct rotation of the upper first molars. The mesiobuccal cusps should be placed well buccally to correct cusp interference. The correction of occlusal interference has been called to the attention of the profession by both Rogers and Lourie. These points in treatment cannot be separated from muscle exercises because, without them, muscle exercises would be useless.

After these points have been cared for, several other functions should be checked. I furnish the patient with chewing gum to use in my presence and allow him to chew it freely. Walking away from him for a minute or two, I put him at ease. At the same time, I observe the movements of the mandible and the position of the mandible during the act of swallowing and during conversation. The tongue position during the act of swallowing should also be noted. When these functions are found to be abnormal, immediate steps should be taken to correct them. Rogers' exercise for the improvement of function of the internal pterygoid muscle should be employed. The patient should also be taught to practice swallowing with the mandible in the normal forward position and with the teeth locked at the moment of swallowing. If the tongue is held habitually in the floor of the mouth, a corrective exercise should be given as suggested by Lourie.

Figures 2 to 7 show four severe Class II cases which would be classed under mandibular retroversion. The treatment in all these cases was completed several years ago, and the final results have been checked over a period of years. Exercises as taught by Rogers were used to restore balance and harmony to the two divisions of the muscles of mastication. The function of the facial group of muscles was restored by the use of the lip depressor exercise described in this paper. In Figures 8 and 9, a Class II, subdivision, case of malocclusion is shown. The facial muscles were in extreme malfunction. The use of the depressor lip exercise has made a worth-while improvement in this case, but further improvement is expected. In Figures 10 and 11 is shown a Class II, Division 2, case complicated by a deficiency in the vertical dimension in the molar segments, and a deep overbite of the anterior teeth. The use of the temporal-mandibular exercise with a bite-plate assisted in the correction. Figures

12 and 13 show a Class II malocclusion with a severe crossbite condition on the left side. The use of bite-plates and the temporal mandibular exercise greatly facilitated the correction of this case. In Figures 14 and 15 is shown a Class I case with a deficiency in vertical dimension in the molar region, and a deep overbite of the anterior teeth. The use of the depressor lip exercise accomplished much in restoring facial balance. At the same time, it was necessary to improve the function of all of the muscles of mastication.

SUMMARY

1. The denture is a dynamic mechanism and as such is composed of not only the teeth and their immediate investing tissues, but also the maxillae and the mandible, together with the muscles used in mastication and deglutition, and the facial group of muscles.

2. Growth and differentiation of the denture, and to some extent of the face, are influenced by the functional forces of the denture.

3. An imbalance between the group of muscles which close the jaws and the group of muscles which open the jaws seems to exist in some cases of Class II malocclusion and must be corrected as a retention measure.

4. The static function of the lips and associated muscles normally limits the forward movement of the teeth, but, when this function is deranged, an imbalance of forces exists and it becomes a cause of malocclusion.

5. Exercises to correct malfunction and imbalance of muscle groups, both for the muscles of mastication and for the lip group of muscles should be employed by the orthodontist when and where indicated.

6. The muscular forces acting on the denture are of great complexity and very difficult of analysis. This fact is complicated by habit patterns, of which there are a great variety.

BIBLIOGRAPHY

1. Noyes, H. J.: Function and Retention. *Arch. Chicago A. Orthodontists,* 1936.

2. Keith, Arthur, and Campion, G. C.: Contribution to Mechanism of Growth of Human Face. *Internat. J. Orthodon.,* 8:607, October 1922.

3. Howard, C. C.: Inherent Growth and Its Influence on Malocclusion. J.A.D.A., 19: 642, April 1932.

4. Brash, J. C.: Aetiology of Irregularity and Malocclusion of Teeth. (Dental Board of the United Kingdom.) 1930.

5. Hellman, Milo: Physiological Treatment. *D. Cosmos,* 72:578, June 1930.

6. Todd, T. W.: Integral Growth of the Face. St. Louis: C. V. Mosby Co., 1936.

7. Rogers, A. P.: Exercises for Development of Muscles of Face, with a View to Increasing Their Functional Activity. *D. Cosmos,* 60:857, October 1918.

8. Wallace, J. S.: Variations in Form of Jaws. St. Louis: C. V. Mosby Co., 1926.

9. Strang, R. H. W.: Text-Book of Orthodontia. Philadelphia: Lea and Febiger, 1933.

10. Stuteville, O. H.: Investigation of Musculature by Vivisection of Monkey. Unpublished data.

11. Brodie, A. G.: Habits and Musculature. *Arch. Chicago A. Orthodontists,* April 1932.

12. Friel, Sheldon: Investigation into Relation of Function and Form. *Brit. D. J.,* 47: 353, April 1926.

13. Kirkes, W. S.: Handbook of Physiology. Seventh American revision, 1910.

14. Rogers, A. P.: Increased Function in Treatment of Dental Anomalies. *Internat. J. Orthodon.,* 15:731, August 1929.

15. Angle, E. H.: Habits. *Am. Orthodontist,* 3:1, July 1911.

16. Lourie, L. S.: Some Abnormal Functions Associated with Malocclusion. J.A.D.A., 15:797, May 1928.

17. Oppenheim, A.: Prognathism from Anthropological and Orthodontic Viewpoints. *D. Cosmos,* 70:1170, December 1928.

18. Hellman, Milo: What About Diagnosis and Treatment of Class II Malocclusion of the Teeth? *Internat. J. Orthodon.,* 17:113, February 1931.

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RÔLE OF ORAL HYGIENE IN PREVENTIVE DENTISTRY

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SINCE the inauguration of the first dental school in America, in 1840, the mechanical aspect of dentistry has enjoyed an overwhelming amount of concentrated study, with the result that, in many practices, the preventive phase has been much neglected. Today, however, the prevention of dental disorders, and rightly so, is gradually taking precedence. This may be due to the natural biologic evolution of dentistry or to the addition of the dental hygienist to dental practice, or to both. The adoption of the slogan "Preventive Dentistry in the Interest of Public Health" in 1937 and "Dental Health for American Youth" in 1938 by the American Dental Association can be interpreted as a highly effective means for turning the attention of the profession toward greater effort in preventive dentistry. Progressive health educators throughout the country are demanding more and more information on dental health.

As my practice for the past eleven years has been limited to pedodontia, and since it is generally acceded that prevention begins with the child, I shall discuss the rôle of oral hygiene in preventive dentistry, covering only those hygienic measures essential for the mouth health of children from 2 to 16 years of age.

Oral hygiene for children, in its broadest sense, should include not only pedodontexesis, which means the scaling, cleaning and polishing of the teeth of children, commonly known as dental prophylaxis, and definite instructions in home care, but also the removal of root fragments and abscessed teeth, the correction of overhanging fillings, the restoration of proximal contacts and the general elimination of all other conditions of the teeth that cannot be corrected by operative intervention. However, it is generally accepted among the profession that oral hygiene is synonymous with oral prophylaxis.

The scaling, cleaning and polishing of the teeth of children is looked on by many dentists as a simple and unimportant procedure rather than an essential part of oral hygiene. It is, without question, the dental health service which the parent is least inclined to seek at regular intervals for the child. This is due partly to the fact that there seem to be two schools of thought regarding when the child's teeth should be cleaned: one, that it should be done at the initial visit of the child, provided the patient is not in need of relief from pain; the other, that it should be done at the final visit and combined with the polishing of the fillings.

If dentists would stress the need for having the child's teeth cleaned as a prerequisite for a thorough mouth examination before attempting restorative work, the problem of convincing the parent of its importance would be solved. The dentist or hygienist who gives the dental prophylactic treatment also has a better

Read before the Section on Operative and Preventive Dentistry as a part of a symposium on preventive dentistry at the Seventy-Fourth Annual Midwinter Meeting of the Chicago Dental Society, February 15, 1938.

opportunity to note the ordinary amount of home care given the teeth. The more visits the child makes to the office, the more interested in dental care the parent and child become. Then, too, many of the pit and fissure areas are detectable with a sharp explorer only after the teeth have been thoroughly cleaned and dried with air. When the child patient is recalled in three months for the periodic check-up, the parent will be educated to expect to have the child's teeth cleaned before a thorough mouth examination is made. Parents will readily pay for a dental prophylaxis and examination for their children, but frequently are reluctant to pay for the examination alone.

The practice of combining dental prophylaxis with polishing of the fillings at the final visit should be discouraged. It does not impress the parent nor the child with its importance and much of the instruction in home care, which would be retained if a definite rule of dental prophylaxis at the initial visit were established, is lost.

Before the dental prophylaxis is begun, the operator should have a systematized method of procedure. In every child's mouth, three conditions should be observed: first, the occlusion of the teeth, to detect any malformation which may be due to a pernicious habit; second, the degree of home care, to determine what areas are missed in the toothbrushing, and, third, the masticating habits of the child, to ascertain whether the child chews on both sides of the mouth. If the teeth are cleaner on one side than on the other, we can be quite certain that the child masticates only with the clean side. This may be due to habit, which can be corrected by calling the child's attention to it, or it may be caused by something that will require operative correction, such as a cavity, retained deciduous roots and food packing in the proximal areas, an abscessed condition or malocclusion.

A bugbear in pedodontexesis is the use of a solution to disclose the accretions on the teeth of the child patient. A disclosing solution is an unnecessary evil. It has a vile taste and tends to destroy the child's pleasant reactions toward dentistry in general. Nine children out of ten are nauseated from it and nothing is gained by its use. It is just "nasty" medicine to the average child, and the mother is too sympathetic to endeavor to understand why it is used.

Abuse of the reward system with child patients is another evil that should be corrected. Children, generally, are very appreciative of rewards, and rewards can be made an educational part of one's practice. Professional people should be very cautious as to what types of rewards they give their patients. Some dentists have a tendency to belittle their professional standing by handing out samples of this and that without any thought of what the effect may be. If a reward system is used, it should be first of all kindness, consideration and good operative procedure; and, second, something of a dental health educational nature. Material in pamphlet form portraying optimism and stressing the need for dental prophylaxis and examination at least every three months, the value of good food habits and the need for proper home care and telling how dental health can be enjoyed by every child is very appropriate. Only material that is prepared and distributed by official health organizations should be given the child. Distribution of pamphlets and other material of a commercial nature destroys confidence and reflects poor judgment.

The primary purpose in a dental prophylaxis is to polish the teeth and make them more resistant to the formation of bacterial plaques and to caries. Therefore, the selection of a cleansing paste should be given careful thought. No preparation should be used that is abrasive enough to scratch the enamel even to the slightest degree. As a measure of safety, we might, in our everyday prac-

tice, apply the simple test for abrasiveness developed by the United States Bureau of Standards, which is as follows:

A piece of glass and a piece of alloy metal of the size and hardness of a five-cent piece are all that are needed for this test. First test the glass for hardness by rubbing the edge of the metal piece over it to be sure that the metal alone does not scratch the glass. Human enamel and glass both vary in hardness. The grade of soda-lime glass used in microscopic work was found to be harder than any of the enamel tested at the Bureau. Place some of the cleansing paste to be tested on the glass and rub again with the coin. If scratches result, then you may expect scratches on your teeth. This test is sensitive enough to detect one part of emery in one hundred thousand parts of paste.

The years of childhood from 2 to 16 may be divided, from the standpoint of oral hygiene, into three distinct groups: first, the deciduous dentition period (2 to 6); second, the transitional dentition period (6 to 11), and third, the permanent dentition period (11 to 16). You may wonder why I did not make some mention of the prenatal as well as the period from birth to two years of age. I can, I think, freely and rightly say that the responsibility for dental health during these periods of childhood rests with the pediatrician or with the expectant mother's dentist rather than with the pedodontist.

Group 1. The deciduous dentition period, covering the years of childhood from 2 to 6, is probably the most impressionable habit training age even from the standpoint of oral hygiene. During this period, the child usually makes his first contact with the dental office. Therefore, his experiences should be pleasant, with the result that his reactions toward dentists and dentistry will be favorable. This type of reaction can be assured by establishing confidence through the use of psychology and patience on the part of the office personnel.

Two distinct oral conditions, the black and the green stains, are more frequently present in this age group. The cause for the formation of these stains is not definitely known. However, the green stain is most commonly found in mouths when the intake of carbohydrates is great and the home care is negligible. The use of hydrogen peroxide assists immeasurably in the removal of green stain, as it somehow tends to bleach the chromogenic accretions on the tooth surface. As for the black stain, there is no safe medicament that will assist in its removal. Fortunately, only a small minority of children have a susceptibility to black stain and, in a great many of these cases, the condition persists only with the deciduous teeth. It seems that black stain is, for some unknown reason, more commonly found in girls than in boys. In certain mouths, black stain possesses a penetrating power in that it embeds itself in the enamel and roughens the enamel surface. In mouths in which this type of black stain is found, the teeth usually are highly susceptible to decay; whereas the superficial type of black stain is often present in mouths practically immune to caries.

After seating a child of from 2 to 6 years of age in the chair, it is well to note the number of teeth erupted and to make a general survey of the mouth, observing the occlusion, masticating habits and home care, then quietly introduce the various instruments necessary to begin the operative prophylactic procedures. The rubber cup polishers in the contra-angle handpiece, with flour of pumice slightly flavored for the buccal, labial and lingual surfaces of the teeth, are most acceptable for the young child. During the deciduous dentition period, few children have an accumulation of calculus on the lingual surfaces of the lower anterior teeth. However, if calculus is present, it should be removed with a scaler before the polishing is begun. The occlusal surfaces should be cleaned with midget brushes and cleansing paste. A

fine linen strip or tape floss can be used to clean the proximal surfaces of the teeth.

The greatest problem encountered in giving a dental prophylaxis to a child for the first time is the use of the water and air syringes. No operator should surprise a child by using either air or water unexpectedly. The child should be told as we proceed what we are going to do. He will submit to a dry field examination, not only for caries, but also as a means of detecting unremoved stains and unpolished surfaces.

When teaching a child home care of the mouth, it is well to invite the parent into the room. There are five major dental health habits to be stressed for home care during the deciduous dentition period:

1. Every child should be taught to brush the teeth after breakfast, after lunch and before going to bed at night without fail and the night brushing should be done by the parent or nurse.

The mistake often made by mothers is that of teaching their children to brush the teeth before breakfast and many mothers are reluctant about changing this practice. However, when the child is young, if the importance of brushing the teeth after breakfast is explained to the mother, she will usually change without hesitation. The right dental health habits are essential if prevention is to be effective early in the life of the child and early in the life of the tooth.

2. Every child should possess three toothbrushes of proper size and shape, one to be used after breakfast, one after lunch and the other before going to bed at night; thereby allowing them to thoroughly dry and regain their original stiffness.

For the child of from 2 to 4 years, the single-row brush with from six to eight well-spaced tufts of bristles should be prescribed. This makes the brushing procedure more pleasant and, at the same time, is as effective as when the larger brush is used. When there is normal spacing of the teeth, at about the age of 4, the regular two-row junior brush of average size should be used. Mothers should be instructed in the care of the toothbrush in order to preserve its stiffness and some degree of sanitation by stressing the importance of rinsing it with cold water only and allowing it to dry thoroughly in the open room, since the germs that grow in the mouth grow in darkness. This is especially important to mothers who have acquired a germ phobia and tend to accept the incubator type of toothbrush holders.

3. Every child should be instructed in the correct method for brushing the teeth. The generally accepted method of brushing the upper teeth down and the lower teeth up is a good technic for this age group.

If the hint regarding brushing all the teeth with a dry brush and allowing the saliva to moisten it well before using the toothpaste is carried out, the toothbrushing is usually done more thoroughly without making it appear a long-drawn-out task.

4. Every child should have prescribed for him an accepted toothpaste rather than a toothpowder, because young children tend to inhale the toothpowder, and for this reason alone the use of toothpowder should be discouraged.

The profession cannot be too cautious in the prescribing of a dentifrice and must prescribe one in which the content is known. We must remember that any product of secret formula is classified as a patent medicine, and therefore should not be prescribed by dentists. In my pedodontic practice, I have seen many deleterious effects of using an unsafe product. We must remember that medicaments or any allergic products affect the child more readily than the adult because the child has not had an opportunity to develop the same degree of immunity. The only safe method to follow in the selection of a dentifrice is to pre-

scribe, and caution the parent to use, only those products bearing the seal of acceptance of the Council on Dental Therapeutics of the American Dental Association.

5. Every child should establish the habit of chewing on both sides of the jaws, thereby exercising all the teeth and allowing the jaws to develop symmetrically if at all possible.

The establishment of good masticating habits early in life not only tends to preserve the oral health, but also enables the child to enjoy his food and to profit from good digestion and good assimilation.

Teaching health habits for home care of the mouth in the deciduous dentition period involves more than the presentation of facts. We must develop the child's imagination so that these facts will have meaning and interest.

Group 2. The transitional dentition period, covering the years of childhood from 6 to 11, is probably the most trying in the child's life. During this period growth is rapid, activities are increased and contact with contagious diseases is most frequent. The physical bodily changes, including the exfoliation of the deciduous teeth and the eruption of the permanent teeth, all take place within this five year period. In other words, we have an increased susceptibility and lowered immunity, making oral hygiene of greater importance from the standpoint of preventive dentistry.

The technic of pedodontexesis between the ages of 6 and 11 varies in only a few details from the technic employed during the deciduous dentition period, but, first of all, we have added hand polishing with the porte polisher, putting more effort on the careful polishing of the permanent teeth. We also have to remove with scalers increased accretions on the teeth, which are due to the exfoliation of the deciduous teeth, the eruption of the permanent teeth, impaired mastication and less vigorous toothbrushing. These accretions are usually accentuated by what appears to be an orange-colored stain. Although this stain is easily removed with cleansing paste and rubber cup polishers, the child's attention should be called to that particular area when the home care of the mouth is stressed. Careful observation should be made of the erupted teeth as compared to the normal, to prevent prolonged retention; to the condition of the gingival tissues and the possibilities for focal infection; to overhanging fillings and the occlusion, and, again, to the importance of home care.

Polishing of the proximal surfaces of the teeth with tape floss and cleansing paste or the regular prophylactic strips is very effective in reducing the amount of decay and should be routine in pedodontexesis during the transitional dentition period. At the age when the exfoliation of the second deciduous molar is about to take place, as another preventive oral hygiene measure the parent is instructed to bring the child in for an examination of the mesial surfaces of the first permanent molars immediately after the loss of the second deciduous molars. If this area gives any indication of caries, the teeth can be filled without the destruction of a great deal of tooth surface. If no caries is present, the mesial surfaces of the first permanent molars can be well polished to further increase their immunity.

The effectiveness of oral hygiene measures is greatly reduced during the transitional dentition period because the teeth are then more susceptible to caries and harder to brush, and the average child has not the time to care for his teeth consistently. However, some comprehensive effort should be made by the dentists to supervise both the home care and the eruption of the teeth. The ectopic eruption of any one tooth in the mouth reduces the possibilities of preventive care, not only from the standpoint of oral hygiene, but also from the standpoint of mastication, normal development and

growth. Likewise, prolonged retention often results in irritation around the offending tooth, which may become very extensive within a short time. Another oral hygiene hazard is the submerged deciduous tooth. We must also bear in mind the fact that any condition that impairs mastication impairs oral health. Next to dental caries, the most serious menace to mouth health is the abscessed tooth. The child, like all other human beings, unconsciously seeks comfort during both mastication and home care. Abscessed teeth must be eliminated, not only for mouth health, but also for general health, because general health is a good index to increased possibilities for oral health. Unless some effort is made to educate the parent as to the value of increased dental supervision during the transitional dentition period, much is lost in the way of individual mouth health even though the loss may be only temporary.

Presentation of the subject of home care of the teeth to children from 6 to 11 years is not necessarily a task, if the child is in a receptive mood. The important factors to stress besides dietary habits and the five major health habits already outlined in the deciduous dentition period are:

1. The brushing of the teeth should be done before a mirror and special care should be exercised on the areas that show the results of ineffective toothbrushing.

After the eruption of the first permanent molars, the general consensus of opinion is that if the mouth is opened wide during the brushing procedure, the tooth will be well brushed. That is a great fallacy because the contraction of the muscles tends to force the brush away from the buccal surface and it is there that added concentration is needed. The child should be instructed to close slightly when brushing the posterior areas in the mouth. Often, for the child from 6 to 8, to assign a number of strokes on the buccal surfaces of the first permanent molars is desirable. The benefits in mouth health to be derived from having the child count the strokes while brushing the teeth are surprising.

2. Every child should have definitely prescribed for him three junior two-row shaped brushes.

Dentists and hygienists make a grave mistake in allowing a child from 6 to 11 years to use an adult brush of regular size. We must remember that the size of the jaws does not warrant this rapid change and that it is desirable for the child to learn to handle a junior brush well before changing to an adult size. Then, too, for this age group, our instructions must be detailed, even to the extent of indicating which brush is to be used at each brushing. Now that colored handles are available, this should not be a problem, but we must be certain that the child understands the importance of allowing the brush to become thoroughly dry between brushings.

3. The method of brushing should be the same as during the deciduous dentition period.

The technic of brushing should not be complicated by any form of interproximal stimulation. Again, the importance of the dry brush method before employment of the toothpaste is stressed.

4. Every child should be instructed to massage the gums with the finger after the night brushing.

This procedure increases the circulation and reduces the possibility of soreness from exfoliation and eruption of the teeth.

In teaching home care during this period, it is evident that girls are more precise in carrying out instructions, but interest in tooth care increases in all children with age.

Group 3. The permanent dentition period begins with the child of 11 and, in most pedodontic practices, extends until the close of the sixteenth year. Normally, according to the newer theories of

calcification and eruption, there are now only permanent teeth in the mouth, fully erupted or about to erupt. When considering the rôle of oral hygiene in preventive dentistry during this period, we must remember that the child has emerged from childhood into adolescence and has a marked degree of susceptibility to diseases, including oral disease.

If the mouth has suffered from inadequate dental supervision, we may be confronted with the problems of impacted and unerupted teeth. Both these conditions tend to decrease the possibilities of mouth health and impair home prophylaxis. We may also have the other extreme—prolonged retention of the deciduous teeth. The ectopic eruption of teeth as a result of prolonged retention reduces mouth cleanliness. The bicuspids and cuspids are more frequently malposed as the result of prolonged retention, a condition which can largely be prevented by regular supervision supplemented with roentgen-ray examination and a working knowledge of tooth growth and development.

Closely related to the problem of prolonged retention is that presented by the deciduous root fragment remaining in the jaw after the crown of the deciduous tooth has been exfoliated. These root fragments tend to destroy the contact and allow the food to pack in the interproximal space, thereby irritating the soft tissues. Frequently, the deciduous root fragments are not discovered until later in life and, if the bicuspids have been extracted, they are often mistaken for bicuspid root fragments. The loss of contact in the bicuspid area always warrants roentgenographic examination before any attempt is made to restore or provide normal contact by some artificial method. Therefore, the use of the roentgen rays is a necessary adjunct to all phases of dentistry for children during the dentition periods, and roentgenograms must be utilized freely even in the field of oral hygiene if the mouth is to be maintained in health.

The procedure for giving a dental prophylaxis for a child in the permanent dentition period does not differ greatly from the method employed during the transitional dentition period. However, polishing of the interproximal spaces with prophylactic strips or tape floss and cleansing paste should be carefully and thoroughly done. All calcareous and serumal deposits must be removed without lacerating the soft tissues.

All patients should again be instructed in home care of the mouth as outlined for the transitional dentition period, the dentist requesting more gum massage by finger pressure and increasing the massaging requirements to both morning and night. It is also important to teach the child the use of tape dental floss, instructing the patient how to hold it and how to use it, besides cautioning him to avoid lacerating the gums. If the child of 11 is instructed to use tape floss on the anterior teeth, first wiping the mesial surface of one tooth and then the distal surface of the proximate tooth, much can be done to prevent interproximal decay. As the teeth erupt and grow into normal alinement, the tape floss measure can be extended to include all teeth. We must implant uppermost in the child's mind, the thought of the danger involved in the careless use of floss. However, the possibility for injury is considerably reduced with the tape type of dental floss.

During the permanent dentition period, we are sometimes confronted with clean mouths in which caries is rampant. These patients probably have a glandular disturbance, and in such mouths caries cannot be appreciably reduced through mouth cleanliness alone.

Procedures for the maintenance of mouth health for the child have been considered in detail that we may adopt a standard of value for oral hygiene in preventive dentistry. It is my contention,

after eleven years of private practice limited exclusively to dentistry for children, that if the patient conscientiously strives to carry out instructions to keep the mouth clean and returns for periodic check-up at least every three months, oral hygiene can and will reduce the ravages of dental decay. It is true that the children in private practice cannot be considered a control group from a scientific standpoint, yet each child responds according to the degree of cooperation given, in that those children who are more conscientious show greater benefits.

Scientists up to the present time have not discovered any serum, vaccine or specific whereby one can be inoculated and thereafter be forever free from dental disease. Until more definite and positive methods of control are discovered, we must rely on oral hygiene as one of the most important factors in the prevention of dental disorders.

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PRACTICAL PHASES OF LOCAL ANESTHESIA

By Howard C. Miller, D.D.S., Chicago, Ill.

IN any surgical procedure within the mouth, the selection of an anesthetic is an extremely important step. The decision as to the anesthetic to be used should be based upon the training and experience of the operator, the physical condition of the patient and the type of operation to be performed. There is no one anesthetic best suited to all cases, but there is generally one that is best suited to the individual and to the operation. The successful operator selects the anesthetic best adapted to the case, the one from which the patient will receive the maximum benefit.

If regional or block anesthesia is the anesthetic of choice, it must be remembered that its successful administration calls for scrupulous asepsis, proper anesthetic solution, a thorough knowledge of the anatomy of the parts involved and an exact technic. Clinical investigation and research have revealed certain facts that should be of value to the dental practitioner, some of which may be stated as follows:

1. Procaine (novocaine) is the most effective and the safest local anesthetic agent available at the present time. This conclusion is based not alone upon the wide clinical application of procaine solutions, but also upon the accepted methods for determining the concentration per cent, efficiency ratio and toxicity, and the duration of action of local anesthetic solutions.

The methods usually employed for such tests are:

(a) Nerve block; e.g., the standard frog sciatic nerve method.

(b) Efficiency on mucous membrane; by application to the human cornea and to the rabbit cornea.

(c) Injection efficiency; by the standard wheal test on man.

(d) Toxicity; by subcutaneous and vein administration in guinea-pigs, rats, cats and dogs, which also furnishes an index on respiration, heart condition and circulation.

Read before the Section on Oral Surgery, Radiology and Anesthesia at the Seventy-Fourth Annual Midwinter Meeting of the Chicago Dental Society, February 15, 1938.

In making a survey of local anesthetic agents that have been used clinically, some more extensively than others, with a comparison as to their local effects, tolerated dosages, systemic toxicities and therapeutic margins of safety, the fallacy of evaluating the anesthetic efficiency of a product on the basis of one test only can readily be seen. The broad field of usefulness can be determined only by noting the efficiency when applied under varying conditions, thus taking into account the variability as to absorption. The final analysis, in any case, must be governed by the margin of safety or the ratio between the effective and the minimal toxic dose. For general usefulness, combining the maximal efficiency and minimal toxicity, procaine is easily the local anesthetic of choice today as in 1905, when it was first synthesized.

2. Of the available vasoconstrictors, epinephrine, cobefrin hydrochloride and neosynephrine seem to be the most desirable for dental operations. The practical usefulness of any local anesthetic depends primarily on the abolition or the blocking of sensory impulses from the field of operation. In order to accomplish this with the local anesthetic agents available today, the addition of a vasoconstrictor in some form is necessary to prolong anesthesia and to lessen the tendency toward toxic reactions due to too rapid absorption of the injected solution, thus facilitating dental operative procedures and eliminating as far as possible any systemic effects due to mass absorption of the local anesthetic injected.

The prolongation of anesthesia and the maximal limitation of systemic toxicity of local anesthetic compounds are best accomplished by the combined use of an anesthetic agent with maximal efficiency and greatest margin of safety, with a vasoconstrictor of the epinephrine type.

3. The solution should contain a minimal amount of epinephrine (never exceeding 1 :50,000 solution) or one of the weaker vasoconstricting agents, such as cobefrin hydrochloride or neosynephrine. When the more dilute solutions of epinephrine are used, or when one of the weaker vasoconstrictors is employed, the resulting change in blood pressure and pulse rate and the tendency to untoward and disturbing clinical reactions will be less pronounced.

4. Scrupulous asepsis must be adhered to throughout the entire procedure. Absolute asepsis in the mouth is, of course, not possible, but at least an aseptic technic can be followed by which the area of injection is protected from contamination. Instruments, syringes and needles should be sterilized by autoclaving or boiling, and the utmost care should be taken in preparation of the anesthetic solution. The mucous membrane of the region to be injected should be dried, after which some germicidal agent is applied to render the part as aseptic as possible. A sterile needle should be used for each subsequent injection. The same needle should never be used for additional deep block injections in various locations.

With the increasing popularity of prepared solutions sold to the profession in glass containers manufactured to fit syringes of various designs, there has been a tendency to use too little care in preparation of the syringe and glass container before making the injection. When this form of solution is used, the syringes should be autoclaved or boiled and the glass container should be placed in a germicidal solution for sufficient time to assure its asepsis. The anesthetic solution should be warmed approximately to body temperature. In many cases, prophylactic treatment is indicated before surgical interference is attempted. A neglected, inflamed and unhealthy mouth should be brought to as healthy condition as possible before regional or block anesthesia is used. Every attempt should be made to maintain a definite chain of asepsis and to prevent the introduction of bacteria through neglect of this phase,

which is of great importance to any surgical technic.

5. The confidence of the patient should be gained beforehand in order that his excitement and fear may be allayed. He should be advised as to what is to be done and of the sensations and after-effects to be expected. In an extremely nervous patient, in whom extensive operative procedure may cause shock, some form of preoperative medication is indicated. Administration of pentobarbital sodium (nembutal), 1.5 grains, from thirty minutes to one hour before operation, has been found very satisfactory in such cases.

6. The patient should always be in the recumbent or semirecumbent position when injection is made, never sitting upright in the dental chair. When this procedure is followed, fewer symptoms of toxic reaction will occur and the tendency toward syncope will be greatly reduced.

7. Injection should never be made into or through an infected or inflamed area. This precaution hardly seems necessary, but, with the many acute infections that follow injection, particularly in the third molar area, it apparently will bear repetition.

In dealing with any acute type of dental infection, great care must be exercised in the use of a local anesthetic, since, even in the early stages, the extent of tissue involvement and the virulence of the organism are unknown.

8. The solution should be injected slowly, with only sufficient pressure to discharge it into the tissues at the entrance or exit of the nerve trunk from its bony canal, or into the soft tissues along the mucobuccal fold of the teeth to be anesthetized. If the needle is inserted in the dense surrounding gum tissue and the solution deposited under considerable pressure, far more primary pain will result, with an excessive amount of tissue irritation and postoperative discomfort. The solution should be at or near body temperature at the time of injection.

9. Care should be taken never to make an injection into a vein or artery, because this greatly increases the toxicity of the anesthetic solution. It may be prevented by moving the needle back and forth slightly while the solution is being discharged; or the plunger may be retracted in order to determine whether a blood vessel has been entered.

10. The maintenance of normal breathing throughout is of utmost importance. Frequently, a patient will hold his breath or the breathing may become shallow, particularly with the first insertion of the needle. This results in a lack of oxygen in the system (anoxemia) and very often is a factor in the development of some of the unfavorable symptoms.

11. The patient should be restrained from raising his head to expectorate into the cuspidor immediately after injection. Such exertion may precipitate a severe reaction, which can be avoided by supplying a small basin for this purpose.

12. In the presence of definite heart impairment or other serious physical disability, operative procedure should be restricted to a small area, which can be anesthetized by a minimal number of injections, and the smallest possible amount of solution.

13. If there are signs of toxic reaction, such as apprehensiveness, tremor, heart consciousness, labored respiration, rapid pulse, pallor, beads of perspiration or syncope, the patient should immediately be placed in a horizontal position with the head lower than the body. The face is wiped or slapped with a towel wrung from cold water and one of the indirect heart stimulants, such as aromatic spirits of ammonia or spirits of camphor, is administered by inhalation. Stimulation is best supplied by aromatic spirits of ammonia pearls, which are quickly broken and held close to the nostrils, or by placing fresh aromatic spirits of ammonia on

a piece of gauze and forcing the patient to inhale as deeply as possible. If the reaction is not so severe as to cause loss of consciousness, from 20 to 30 drops of aromatic spirits of ammonia in a small amount of water may be administered by mouth.

In cases of respiratory failure, artificial respiration should be instituted and the air passages should be kept free of any obstruction. The use of pure oxygen or oxygen with 5 or 10 per cent carbon dioxide should supplement the artificial respiration. The patient should receive supportive medication, such as a hypodermic injection of caffeine and sodium benzoate 7.5 grains; camphor in oil, or strychnine one-sixtieth to one-thirtieth grain.

In cardiac failure, it is necessary to maintain respiration and employ supportive medication. In cases of collapse of patients suffering from angina pectoris, coronary disease or epileptic seizures, a vasodilator, such as amyl nitrate by inhalation, and hypodermic injections of nitroglycerine one-hundredth to one-hundred-fiftieth grain should be employed. In cardiac failure, hypodermic injection of digifoline should be used, and, in extreme cases, 1 cc. of epinephrine, injected hypodermically, has been found effective.

In all cases of toxic reaction, the patient must be kept under close observation and immediate and proper treatment be instituted at once if serious consequences are to be avoided.

14. A thorough knowledge of the anatomy of the parts involved is essential to the successful use of local anesthesia: Many operators attempt to make deep block injections in a mechanical way, following a technical procedure learned through lectures or from articles dealing entirely with technical phases. The operator should be able to visualize the structures through which the needle must pass, the bony surface and the nervous tissue at the point of injection. When this knowledge is complete, local anesthesia ceases to be a mechanical procedure and becomes a definite surgical technic based entirely upon anatomic landmarks.

15. An exact technic, based upon the knowledge of a simple, safe and efficient procedure, is essential to the successful use of a local anesthetic. To attempt to advance any particular claims or advantages of one technic over another is not the object of this presentation.

In view of the fact that our technical procedures are based entirely upon anatomic relations in the human skull, it is obvious that there cannot be much variation in the manner of injection. Occasionally, refinements in technic are offered in an attempt to simplify the various methods of injection, but, in most instances, these are based upon the procedures followed by those who first presented the technic for blocking various branches of the fifth cranial nerve.

It is hoped that the material presented will assist the general dentist and permit a more critical viewpoint, a better understanding of products in use and a more careful observation of the reaction of the patient to the injected solution and the anesthetic result.

55 East Washington Street.

DIETARY DEFICIENCIES AS A FACTOR IN THE ETIOLOGY OF DIFFUSE ALVEOLAR ATROPHY*

By Paul E. Boyle, D.M.D., Saugus, Mass.

PERIODONTAL disease is an important cause of loss of teeth after the third decade. It is one of the group of degenerative diseases. Attention has often been called to the fact that most of the increase in expectation of life of recent times has been gained through control of the infectious diseases which take their toll chiefly from among the young. Relatively little progress has been made toward prevention of the diseases characteristic of adult life and of old age. Although pyorrhea is not usually a direct cause of death, its progress, with eventual loss of the teeth, may be a matter of great concern. If periodontal disease is a local manifestation of the inability of certain body tissues to repair and maintain their normal structure, it becomes of considerable importance as an indication of senescent changes in the entire organism.

Periodontal disease is of two types: Type I, a local process starting at the gingival crevice, and Type II, a systemic process. The gingival crevice is a weak spot in the covering which defends the tooth against the myriads of organisms constantly found in the mouth. In this respect, the union of the gingiva with the tooth is similar to the junction of the external skin with the nails and with the hair. Pathogenic organisms are always associated with the local process. They may be the primary factor in the destruction of the attachment tissues as in staphylococcic infections and in Vincent's infection. Various mechanical factors may, in other instances, cause the original injury to the gingival tissues, followed by infection with the various pathogenic micro-organisms present in the mouth. Among these mechanical factors are the accumulation of calcified deposits, the impaction of food on the gingiva and injuries caused by faulty dental restorations. The susceptibility to infection and the progress of the disease, once established, is affected by various conditions which go to make up the power of the host to resist infection. Natural and acquired immunity to the organisms concerned, general and local metabolism and possibly the degree of allergy of the tissues are among these.

Diabetes mellitus may serve to illustrate the relation between localized disease processes and systemic disorders. This disease is associated with hypofunction of the islets of the pancreas, which may, in some cases, be the result of disorders in other glands of internal secretion. The blood stream contains an abnormally large amount of glucose. The tissues, including the skin and the mucous membrane of the mouth, on the other hand, contain a greatly reduced supply of glycogen. In diabetes, the formation of pimples and boils is a common occurrence. These lesions are caused by the constant presence of staphylococci

*Aided by a grant from the Milton Fund to the University Committee on Research in Dental Medicine, Harvard University.

Read before the Section on Periodontia at the Seventy-Fourth Annual Midwinter Clinic of the Chicago Dental Society, February 17, 1938.

on the skin. They start at the junction of the skin with the hair shaft. Such lesions may, of course, occur in the nondiabetic. Nevertheless, in a diabetic, the control of staphylococcic abscesses is difficult until the carbohydrate metabolism is restored to normal. Once the systemic metabolism is corrected, restoration of normal metabolism locally in the skin follows, and the measures ordinarily effective in the treatment of abscesses may be used in the diabetic with every hope of success.

Fig. 1.—Maxillary cuspid tooth of human being. The lingual alveolar bone has been resorbed owing to extension of an inflammatory process from the antrum of Highmore. (×12.)

The susceptibility to gingival infections in diabetes is also well recognized. Periodontal disease may progress rapidly in spite of local treatment. With restoration of the metabolism to normal, control of the periodontal lesions by ordinary methods of treatment becomes possible.

Disease is always a complex process. Often, health may be restored by correction of only one factor. There is then a strong tendency to label this factor as the etiologic agent. In other, apparently similar, cases, the disease process may not respond when the previously successful treatment is applied. Confusion then arises because the concept of etiology of the disease has been too narrow. The body may be considered as constantly striving to maintain the harmonious state that we term health. This state may be disturbed in many ways. If the disturbing factors are recognized and controlled, the state of health is reestablished.

No sharp line can be drawn between local and systemic disease processes. Nevertheless, a valid distinction may be made between processes initiated locally and processes which are a local manifestation of systemic disorders. Such a distinction between types of periodontal diseases has been made by Gottlieb[1] on the basis of histopathologic studies. Since locally initiated processes (Type I) are

usually associated with uncleanliness, he applied the term *Schmutzpyorrhea* to this condition. "Pockets" about the necks of the teeth are often formed in the early stages of the disease. As the infection in the soft tissue progresses, inflammatory changes spread to the underlying bone. Resorption of the alveolar process occurs as in other forms of osteomyelitis. (Fig. 1.) The disease usually progresses at a slow rate. Years may elapse between the formation of pockets and loss of the teeth due to destruction of the attachment tissues.

The best examples of *Schmutzpyorrhea* are seen in the mouths of persons who, for one reason or another, chew only on one side and make no effort to maintain hygienic oral conditions. The teeth on the unused side may be covered with deposits, the gingivae inflamed and shallow pockets formed with varying degrees of resorption of the underlying bone. (The overlying inflammatory process accounts for the loss of alveolar bone on a horizontal plane, and generalized rarefaction is also present, being due to disuse atrophy.) The periodontal tissues of the mouth used in mastication may be perfectly healthy.

Experience has shown that, in such cases, the prognosis is excellent if simple clinical treatment, with removal of deposits and restoration of function, is instituted before too great destruction of the attachment tissues occurs. Thoma and Goldman[2] have recently called attention to an interesting adaptation of the periodontal fibers to such destruction of the attachment tissues. As the alveolar septum between adjacent teeth is resorbed, new transseptal fibers are continually formed.

It is obvious that the greater the de-

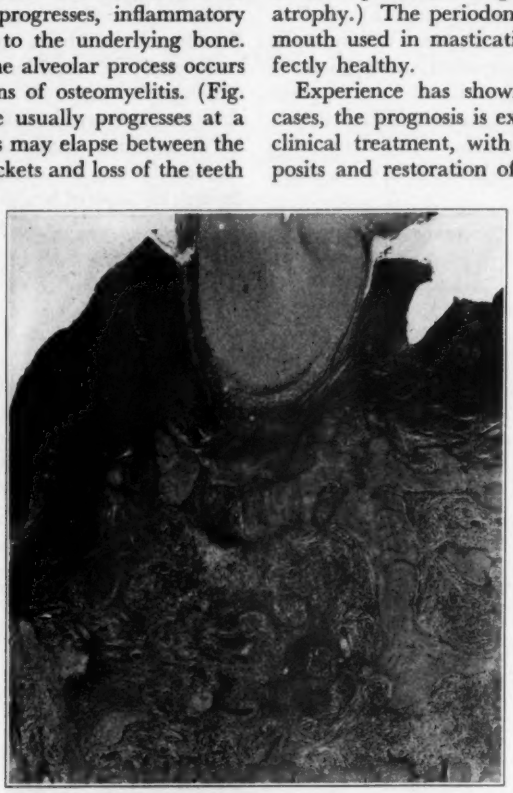

Fig. 2.—Mandibular incisor tooth of dog killed because of advanced trench mouth. The alveolar bone has been resorbed, the tooth being attached by its apical end only. Since the dog synthesizes ascorbic acid, no question of deficiency of this substance is involved. (×12.)

struction of the attachment tissues, the greater the mechanical stress on the remaining tissues. If the inflammatory process is arrested, the pocket obliterated and a healthy gingival attachment to the tooth surface reestablished, considerable redeposition of alveolar bone may take place as in the healing of other types of osteomyelitis. As was made evident by the work of Skillen,[5] little or no reattachment of soft tissues to the tooth surface occurs once they have been separated from the cementum.

Local destructive processes are responsible for periodontal disease in wild and domesticated animals.[4] Impaction of food or débris is the usual cause. Infection with Vincent's organisms may also lead to complete destruction of the alveolar attachment in the dog.[5] (Fig. 2.)

In contrast to *Schmutzpyorrhea,* Type II, or systemic pyorrhea, occurs in well-cared-for mouths. Pocket formation is not an essential part of the disease process, but usually occurs as a late complication. The pockets are often on the side of the tooth from which drifting has taken place. The case published by Gottlieb, as quoted by Kronfeld,[6] is of a 22-year-old man dying of pneumonia following influenza. Microscopically, resorption of the surface of the tooth roots and of the adjacent alveolar bone resulting in a widened periodontal space is found. There is a characteristic loss of the normal fiber arrangement of the periodontium, with substitution of a loose vascular connective tissue.

A case of Type II pyorrhea in a pregnant woman of 28 is also described by Kronfeld. This case was diagnosed on x-ray and clinical evidence, apparently without microscopic study of the periodontal tissues. Loosening of the teeth, with development of spaces between some of them, is reported.

The systemic form of periodontal disease has been described in some detail by Box[7] under the term rarefying pericementitis fibrosa. Loss of the functional periodontal fibers and their replacement by an irregular loose connective tissue is pointed out by this author. Rarefaction of the alveolar bone, with substitution of a fibrous tissue, is stressed as a primary phenomenon in the disease process.

Relative immunity to dental caries in systemic pyorrhea has been reported by many observers.

The systemic type of pyorrhea is characterized clinically by a displacement of the teeth in directions determined by occlusal forces. This displacement is indicative of the inability of the attachment tissues to withstand functional stress. Such inability first becomes evident in regions

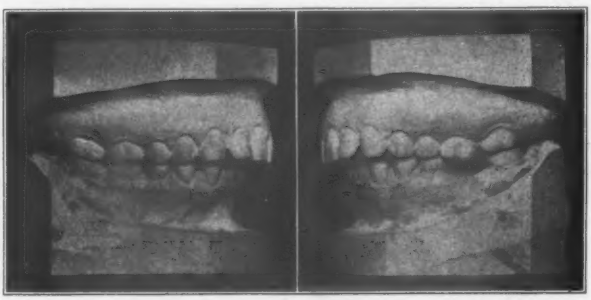

Fig. 3.—Right side of models of dental arches of patient aged 34. The diet has always been adequate in all respects. The mandibular left first molar was extracted fourteen years previously. There is no breakdown of the periodontal tissues.

Fig. 4.—Left side of case shown in Figure 3.

where the stress is most marked. After extraction, the remaining teeth may show a marked tendency to drift into abnormal positions. These teeth are subjected to increased stress following the extraction of their neighbors. Their displacement indicates a fundamental inability to withstand increased stress. Normal periodontal tissues are capable of adjusting themselves to withstand such increased occlusal force as is evidenced by clinical observations. (Figs. 3 and 4.)

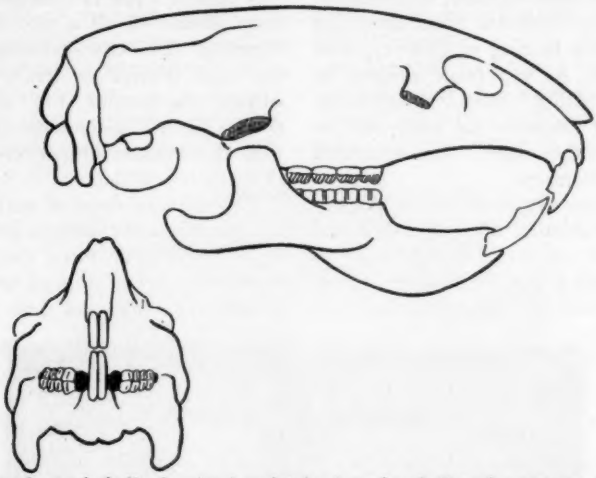

Fig. 5.—Drawings of skull of animal maintained on basal diet plus greens. The edges of the incisor teeth are beveled and the occlusal surfaces of the molar teeth are flat.

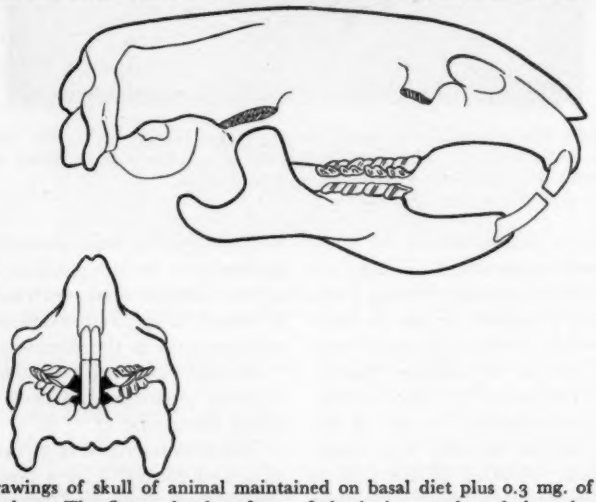

Fig. 6.—Drawings of skull of animal maintained on basal diet plus 0.3 mg. of ascorbic acid daily for 240 days. The flat occlusal surfaces of the incisor teeth and the splayed contact of the molar teeth are to be noted.

Displacement of the teeth by occlusal forces not compensated for by hyper-

plasia of the attachment tissues results in more and more disadvantageous occlusal relations, so that, once drifting of the teeth has occurred, the prognosis becomes unfavorable. However, remission of the process, during which the teeth become firm, may occur.

An interesting difference in the behavior of the alveolar ridges under artificial dentures has been noted between Type I and Type II pyorrhea. In Type I cases, if the teeth are extracted before too great a loss of alveolar bone takes place, the remaining ridges will function well in supporting artificial dentures. In Type II pyorrhea, the ridges continue to be resorbed rapidly under the stress of supporting dentures. The inability to withstand stress remains after the teeth have been removed.

Fig. 7.—Skull of animal shown in Figure 6. The irregular contour of the incisor teeth and their blunt edge and the rarefaction of the alveolar bone are to be noted.

Traumatic occlusion brings out underlying weakness of the attachment tissues. It is a result, not a cause. Displacement of teeth under occlusal stress is similar to the bowing of the legs when a rachitic infant begins to walk. It was once thought that the weight bearing was the cause of the bowing of the legs. It is now recognized that weight bearing merely makes manifest the defective calcification of the rachitic bones. In the same way, displacement of the teeth by occlusal forces merely makes manifest the underlying inability of the periodontal tissues to compensate for an increase of function.

Attempts to produce the systemic type of periodontal disease in animals by the application of excess force have been summarized and reviewed by Kronfeld.[6] He concludes that all such attempts have been unsuccessful in that the ability of the attachment tissues to compensate for increased force has not been impaired.

A number of investigators have called attention to lesions of the periodontal structures of animals maintained on diets deficient in specific substances. Of these substances, the vitamins have received most attention.

The vitamins, which are organic substances formed by plants, are necessary in small amounts to animal nutrition. Iron and iodine are necessary also to animal nutrition, but, being inorganic, are not called vitamins. Much mysterious nonsense has been written concerning the function of the vitamins. As these various substances have been isolated and a better understanding of the rôle they play in metabolism has been secured, it becomes evident that the vitamins function neither more nor less mysteriously than iron or other substances also necessary to the body economy. The term "vitamins" is itself undesirable, as it groups together substances which are unlike in chemical structure.

Vitamin A deficiency is characterized by a substitution of keratinizing epithelium for various highly specialized types of epithelium, such as those of the lacrimal and salivary glands, the cornea and parts of the respiratory and genitourinary tracts.[8] Keratinization of the epithelial cells of the enamel organ of the rat and guinea-pig,[9] as well as those of man,[10] also occurs in this disease. Mellanby[11] has described gingival lesions in dogs maintained on diets deficient in vitamin A. She has also reported the occurrence of similar lesions in animals on normal diets which had, in early life, been subjected to periods of vitamin-A deficiency. In our laboratory, rats and guinea-pigs maintained on diets deficient

in vitamin A show little or no increased incidence of gingival infection or of rarefaction of alveolar bone over that of the starved control animals receiving adequate vitamin A.

Vitamin-D deficiency is associated with failure of bone and tooth matrices to calcify normally. In rachitic animals that we have examined, the alveolar process shows a characteristic excess osteoid margin. In both man and laboratory animals, malformation of the jaws may occur as the result of muscular pull on softened rachitic bones. Such malformation of the jaws and malposition of individual teeth may predispose to periodontal disease. It appears extremely doubtful, however, that vitamin-D deficiency is directly associated with the systemic type of periodontal disease.

Vitamin B_1, B_2 (lactoflavin) and B_6 deficiencies do not, in our experience, cause characteristic lesions of the periodontal tissues.

Vitamin C was the first of the vitamins to be isolated and synthesized. It is a relatively simple organic acid (ascorbic acid or cevitamic acid) closely related to the sugar mannose. It occurs in all cells of the body, but in greatest concentration in those tissues and glands which are functionally most active. It is believed to be necessary for oxidation processes within the cell.

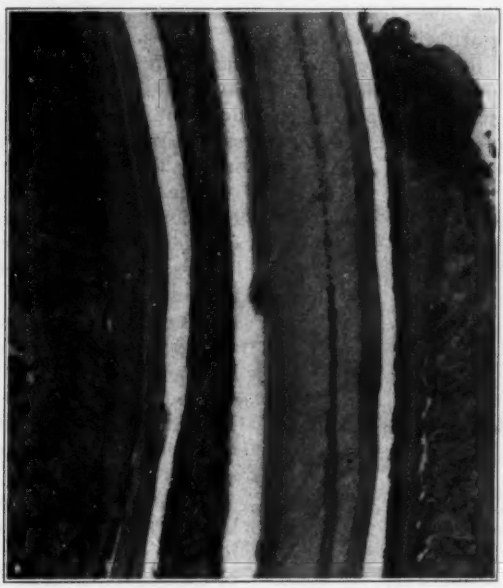

Fig. 8.—Molar tooth and attachment tissues of animal on basal diet plus greens. The lingual alveolar bone on the left side is the chief attachment of these teeth, although they are also suspended by fibers embedded in the buccal alveolar bone and attached to the cementum overlying the enamel on the buccal surface of the molars. The dense alveolar bone and fiber bundles are to be noted. (×35.)

The morphologic sequences of vitamin C (ascorbic acid) deficiency have been thoroughly studied by Wolbach and Howe.[12] They have shown that, in the absence of ascorbic acid, various cells of mesenchymal origin are unable to form

normal intercellular substances. Collagen, the material of which the body forms tendons, ligaments, fascial sheaths, periosteum and periodontium, as well as the connective tissue which supports all other tissues, is not formed in the absence of ascorbic acid. Collagen is a chief component of the matrix of bone and dentin, and these structures are strikingly deficient in vitamin C. This fundamental inability of cells to form collagen adequately accounts for the clinical symptoms of the deficiency disease. The bone, muscle and tendinous structures takes place to compensate for increased functional demands.

The influence of vitamin C on the formation of collagen was clearly shown by Wolbach[14] in his work on wound healing. In the vitamin-C deficient animal, wound healing, both in soft tissue and in bone, proceeds normally up to the stage where collagen should be formed to knit the edges of the injured tissues together. No collagen is deposited in the newly formed tissue until vitamin C is adminis-

Fig. 9.—Molar tooth of animal maintained on basal diet only for four weeks (complete ascorbic acid deficiency). The bone is undergoing rapid osteoclastic resorption and the periodontium is cellular and hemorrhagic. (×35.)

weakness of the collagenous structure is made evident when stress is applied. Thus, as pointed out by Dalldorf,[13] if one leg of a vitamin-C deficient animal is exercised and the other kept at rest, hemorrhages and bone fractures are found in the exercised limb. This is the reverse of the result of exercise in a normal animal, in which hyperplasia of the

tered. This work has recently been repeated and elaborated by Lanman and Ingalls,[15] using methods whereby measurements of the ability to heal wounds of normal and vitamin-C deficient animals could be determined. They found that healing ability in the deficient animals was only one-third that in normal animals.

The experiments of Wolbach and Howe have recently been repeated with synthetic vitamin C (ascorbic acid) rather than natural sources of vitamin C for repair of lesions caused by the deficiency and for the maintenance of normal control animals. In addition, animals have been maintained for long periods on the basal vitamin-C-free diet, supplemented by small daily doses of ascorbic acid (0.3 to 1.0 mg.). Such animals show gross x-ray and microscopic changes from the normal which we[16] have reported as being identical with those characteristic of the systemic type of human pyorrhea.

In animals maintained for several months on suboptimal levels of ascorbic acid (0.3 to 1.0 mg. daily), the failure of the periodontal tissues to withstand functional stress becomes evident by the displacement of the teeth, particularly the molars. The upper molars are frequently forced labially, while the lower molars are driven lingually. The incisor teeth always develop a flat incisal contact in contrast to their normal bevel-edge occlusion. (Figs. 5-7.)

Microscopically, the alveolar bone shows marked rarefaction. The marrow spaces are fibrosed. The collagen fibers of the periodontium become reduced in numbers. The weakness of the periodontal apparatus is shown by the gross loosening of the teeth. (Figs. 8-11.)

It is our opinion that conclusions reached concerning the effect of vitamin C ingestion on the periodontal tissues of the guinea-pig are directly applicable in all essential respects to the human being. Our own studies of human periodontal tissues both in vitamin-C deficiency recognized clinically and pathologically and in the systemic type of pyorrhea strengthen this opinion. Furthermore, the studies of Westin[17] and, more re-

Fig. 10.—Molar tooth of animal on basal diet plus 1.0 mg. of ascorbic acid daily (partial deficiency) for 245 days. The alveolar bone is less dense than normal. (×35.)

cently, those of Brinch[18] on the periodontal tissues of human cases in ascorbic acid deficiency are in essential accord with the original description of Gottlieb of the systemic type of pyorrhea, including the relative immunity to caries of both groups of cases. Moreover, it is now established that severe illness, followed by pneumonia, as in Gottlieb's case, and pregnancy, as in Kronfeld's case of systemic pyorrhea, are associated with an increased need of ascorbic acid.[19] It appears probable that in both these cases there was a vitamin-C deficiency at the time of examination.

Recently, numerous reports of the prevalence of low ascorbic acid levels among hospital clinic patients have appeared in the literature. Examination by Weisberger[20] of a limited number of patients attending the clinics of the Harvard Dental School have shown that blood levels of less than 0.5 mg. per cent of ascorbic acid are frequently encountered. All patients in these low levels have presented gingival lesions which responded to specific ascorbic acid therapy. In a number of such patients, tightening of the previously loosened teeth followed saturation of the blood with ascorbic acid.

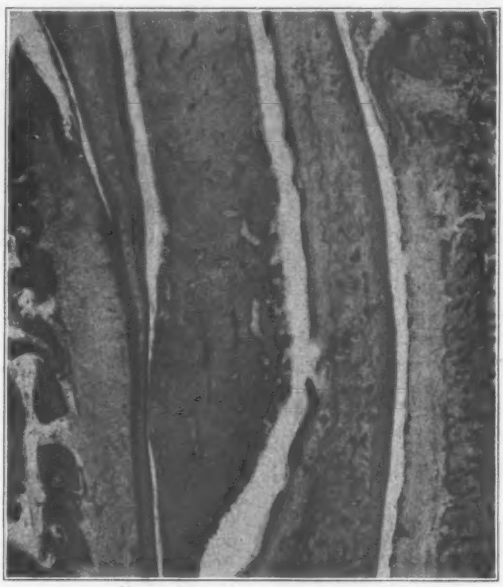

Fig. 11.—Similar region (compare Fig. 10) of animal on basal diet plus 3.0 mg. of ascorbic acid daily for 115 days. There is marked rarefaction of the alveolar bone with fibrosis of the marrow spaces. The periodontal membrane is wide and relatively cellular. The cementum is increased in amount in an attempt to compensate for loosening of the tooth. (×35.)

COMMENT

Vitamin-C deficiency is not universal, nor is the use of vitamin C a panacea for all dental ills. Indiscriminate use of ascorbic acid, particularly coupled with failure to recognize other factors in periodontal disease, is bound to result in many disappointments. Vitamin-C therapy will not prevent nor cure pockets about teeth caused by Vincent's infection or by the impaction of food, though it will aid in the process of healing, if there is a defi-

ciency of this substance and other forms of therapy are used intelligently.

Perhaps an analogy may help. We may again turn to the disease diabetes. In this disease, it is well recognized that following relatively simple surgical procedures, such as lancing an abscess or extracting a tooth, infection may endanger the life of the patient. If, however, the carbohydrate metabolism is first controlled by the use of insulin, surgical procedures can be carried on with a normal prognosis. Surgical interference in a diabetic should therefore be postponed until the use of insulin has corrected the carbohydrate metabolism.

A similar situation exists in vitamin-C deficiency. As in diabetes, the most accurate diagnosis is made by laboratory tests to determine the amount of the substance concerned that is present in a definite quantity of blood plasma, When a deficiency of ascorbic acid exists, it must be remedied by administration of this substance before a normal prognosis for surgical procedures can be expected. In both instances, such therapy is a prerequisite for other treatment, not a substitute.

SUMMARY

Vitamin-C deficiency is the only nutritional deficiency which, in our experience, produces the characteristic features of the systemic type of pyorrhea in experimental animals. Vitamin C is essential to maintenance of health of the oral tissues.

BIBLIOGRAPHY

1. Gottlieb, Bernhard: Tissue Changes in Pyorrhea. J.A.D.A., 14:2178, December 1927.

2. Thoma, K. H., and Goldman, H. M.: Classification and Histopathology of Parodontal Disease. J.A.D.A., 24:1915, December 1937.

3. Skillen, W. G., and Lundquist, G. R.: Experimental Study of Peridental Membrane Reattachment in Healthy and Pathologic Tissue. J.A.D.A., 14:175, February 1937.

4. Colyer, Frank: Variations and Diseases of Teeth of Animals. London: John Bale, Sons and Danielsson, Ltd., 1936.

5. Schnelle, G. B.: Fuso-Spirochetal Disease in Dogs. *North. Am. Veterinarian*, 15:35, April 1934.

6. Kronfeld, Rudolf: Histopathology of Teeth. Philadelphia: Lea and Febiger, 1933.

7. Box, H. K.: Treatment of Periodontal Pocket. Toronto: University of Toronto Press, 1928.

8. Wolbach, S. B., and Howe, P. R.: Tissue Changes Following Deprivation of Fat-Soluble A Vitamin. *J. Exper. Med.*, 42:753, December 1925.

9. Wolbach, S. B., and Howe, P. R.: Incisor Teeth of Albino Rats and Guinea Pigs in Vitamin A Deficiency and Repair. *Am. J. Path.*, 9:275, May 1933.

10. Boyle, P. E.: Manifestation of Vitamin A Deficiency in Human Tooth Germ. *J. D. Res.*, 13:39, February 1933.

11. Mellanby, May: Diet and the Teeth. Part II A. Medical Research Council, 1930.

12. Wolbach, S. B., and Howe, P. R.: Intercellular Substances in Experimental Scorbutus. *Arch. Path. & Lab. Med.*, 1:1, January 1926.

13. Dalldorf, G.: Lesions in Skeletal Muscles in Experimental Scorbutus. *J. Exper. Med.*, 50:293, September 1929.

14. Wolbach, S. B.: Controlled Formation of Collagen and Reticulum. Study of Source of Intercellular Substance in Recovery from Experimental Scorbutus. *Am. J. Path.* (suppl.), 9:689, 1933.

15. Lanman, T. H., and Ingalls, T. H.: Vitamin C Deficiency and Wound Healing. *Ann. Surg.*, 105:616, April 1937.

16. Boyle, P. E.; Bessey, O. A., and Wolbach, S. B.: Experimental Production of Diffuse Alveolar Bone Atrophy Type of Periodontal Disease by Diets Deficient in Ascorbic Acid (Vitamin C). J.A.D.A., 24:1768, November 1937.

17. Westin, G.: Ueber Zahnveränderungen in Fällen von Skorbut bei Homo, I-II. Stockholm: A. B. Fahlcrantz' Boktryckeri, 1931.

18. Brinck, O.: Ueber einige bisher unbekamte pathologische Gewebsveränderungen in der Pulpa und im Paradentium in einem Fall von Skorbut. Deutsche Zahn-Mund. Kieferheilk, 4:297, 1937.

19. Faulkner, J. M., and Taylor, F. H. L.: Vitamin C and Infection. *Ann. Int. Med.*, 10:1867, June 1937.

20. Weisberger, D.; Young, A. P., and Morse, F. W., Jr.: Ascorbic Acid Blood Levels in Dental Patients. *J. D. Res.*, 17:101, April 1938.

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CHILD MANAGEMENT THROUGH PAIN ALLEVIATION

By CHARLES A. SWEET, D.D.S., Oakland, Calif.

MANY volumes have been written and many theories have been advanced on child management by specially trained physicians, by educators and by parents. These theories can be applied successfully to the child in his every-day life, but the problem in the dental office must be given special consideration and study because we are not dealing with the child alone: we are dealing with the child's entire environment, which forms mental hazards further complicating our problem.

FIRST CONTACT

Usually, we receive a telephone call or personal visit from the mother of the child patient explaining in detail that her child is different and she prescribes for us how our treatments should be instituted. We must lend a sympathetic ear to this detailed description and show a decided interest in order to create a favorable impression on the parent. We must always be sympathetic with parents, as they believe sincerely that a great obstacle has confronted or is about to confront their child, an obstacle which will affect the child's entire future life in a dental office and perhaps his entire future well-being.

How frequently does this first interview end with the statement from the parent that "Mary is such a frail nervous child and I do not suppose very much of anything can be done for her—at home, we cannot reprimand her too severly, but must reason everything out with her."

Now is our chance to establish the parent's confidence in us as to our ability to render a professional service. The mother is assured that in five, ten or twenty years of caring for children, we have yet to find the child for whom we cannot do everything that needs to be done without any difficulty. The parent is assured that many similar cases have been treated with complete success and that the most nervous or misbehaved children always become our very best patients.

If this interview has been carried on within hearing of the office nurse, she is asked to recall little Johnnie and little Susan, who were such outstanding cases of incorrigibility, and reminded that they now are fine patients. It is so easy for the office nurse to add "Yes, doctor, there have been many others since I have been with you who have turned out just as well, if not better." Now is the time to tell the parent that if she cares to make an appointment with you, you will be happy to care for the child. At this time, the parent is left with the office assistant to complete this first interview.

The well-trained office assistant not only makes the appointment, but also adds to whatever has been said during the interview by assuring the parent that she has yet to see the child who has not come through this ordeal with flying colors. Her parting remark should be, "You need not worry in the least about

Read before the Section on Children's Dentistry—Mouth Hygiene at the Seventy-Fourth Annual Midwinter Meeting of the Chicago Dental Society, February 17, 1938.

your daughter. If you will just allow Dr. Blank and me to take care of her, everything will come out all right. Your child will enjoy coming to see us and we shall be looking forward to seeing her next Wednesday at 10:30." The appointment, of course, is made for a week-day morning, with the explanation that the child will be fresh, i.e., not tired out from a day at school, and most cooperative; also, the dentist will have just a little more time at that time of day than during the busy after-school rush hours and during the crowded Saturday schedule.

The parent's own mental sufferings, which are transmitted to the child, have been dispersed in thin air, and in its place have been sown the seeds of confidence that her child can and will be well cared for by people who know how to care for her. This feeling will have been transmitted to the child and every one within hearing distance, by word of mouth and general attitude.

The first step in our alleviation of pain has been accomplished.

SECOND CONTACT

At the time of the first interview, the parent has usually been impressed by the way the situation was handled. If it was a telephone call, she has a desire to look things over, so she arrives a little early. A reception room with a few objects of interest to children—perhaps gold fish and books and magazines suitable for children—will make the patient feel at home and at ease. A genuine welcome by the office assistant and calling the child by name, with the remark that Dr. Blank will be ready in just a few minutes, have an influence in the successful care of children.

The child and parent are invited into the operating room, which should give an impression of serious consideration of the problem to be dealt with and not one of frivolity and play. The dentist should welcome the child by calling him by his first name and quietly and affably asking him to seat himself in the operating chair. An examination is made of the child's mouth, the dentist explaining to the parent as nearly as possible the conditions present and the treatment to be instituted. Here is a golden opportunity to inform the parent that the work to be done will be lasting and of great benefit to the child's health and appearance. The decision has been made as to the amount of work, the fee, the payment and the most satisfactory time for appointments. As long as there is cooperation on the part of the mother and the child, the mother may remain in the operating room, but if there is any discord, it is better to have her leave the child in charge of the dentist and his assistant. If it is necessary to have the mother leave the operating room, the child is told that the work must be done regardless of what his desires may be and if he does not cooperate, it will be necessary for the assistant to hold his hand, with the result that the work may be unpleasant, but that if he will help, it is possible that no great unpleasantness will be experienced, and that every precaution will be taken to make it as agreeable as possible for him. This talk with the child should be given in a slow, clear, understandable manner with every indication that the work will proceed regardless of the child's personal desires and he therefore must make the best of the situation.

In many instances, it will be necessary for the assistant to firmly hold the hands in place beside the child, while the dentist proceeds in a firm, determined manner. Usually, this will be the end of all physical resistance. Particularly is this true of younger children. We should not try to fool the child, as he can read us like an open book. No bribes nor rewards should be offered for good behavior, but a word of praise is always appreciated.

If the child cries, no attention is paid

to his crying. The dentist proceeds with the work to be done, as the mouth is open, which proves of assistance to the operator. Crying is the natural defense of all children and possibly of some adults. In due time, it will stop if it does not have the desired results. In extreme cases, it may be advisable to use the towel method to obtain quiet and cooperation, but this should be used only on the obstreperous, not on the nervous, child. It is ineffective to go to the extreme of being too pleasant, as this may lead to promises that will later be broken and build up an everlasting distrust.

By way of illustration: One day the telephone rang and my assistant was greeted by a frantic voice saying "Does the doctor go to the hospital?" This was repeated three or four times before the assistant could intelligently question the speaker. A child had had a tooothache for about a week and no one had been able to sleep in the entire household. The mother at that moment was convinced that it would be a waste of time to try to manage her son other than by taking him to the hospital and removing the offending tooth under general anesthesia. Finally, she was persuaded to bring her son to the office so that we might "just take a look at him."

The child arrived with mother, grandmother and grandfather as escorts. After quieting the family, we observed, bringing up the rear, a small frail little blue eyed boy of about 4 years with deep circles under his eyes and very much excited.

The mother and son, when invited into the operating room, told a story about the family dentist who played "doggy" on his hands and knees for two hours trying to get just one peek at the offending tooth. Finally, the dentist gave up in despair and said the child would have to go to the hospital and have a general anesthetic for an examination and treatment. The mother was given my assurance at this point that, if she would consent to leave the room, I could, with the aid of my assistant, examine the mouth and relieve the toothache. This was agreed to. The child was picked up, seated in the chair and the assistant took hold of two tiny little wrists that resembled bird's legs. The little boy's head was placed in the head rest and his mouth gently, but firmly, forced open. We found all of his molars extremely carious, with several abscessed. When the one that seemed most diseased was opened, the child sighed and settled down as if some great weight had been lifted from his shoulders. Sedatives were sealed in all the offending teeth and the family wended their way homeward to their first good night's sleep in a week.

The little boy was seen the next day and the work started in earnest. Within one month he had gained 6 pounds and most of his dental work was completed.

This small boy taught me the lesson of firmness, friendliness, truthfulness and sympathy as helpers in the alleviation of pain.

THERAPEUTIC AGENTS

We have at our command numerous therapeutic agents which will be of value to us in the relief of mental and physical pain. They should be administered without hesitation.

Sedatives.—The nervous or highly excitable child very frequently should have prescribed for him some sedative before his first few visits to the dentist or at least until an understanding has been reached.

Some one of the following sedatives taken by mouth will be found very useful. The dosage varies according to the weight of the child. The drug is given forty-five minutes before the appointment.

Amytal 1½ to 2 grains (½ tablet)
Sodium amytal, 1½ to 2 grains (½ capsule)
Luminal sodium ½ grain
Pentobarbital, ¾ grain
Codeine, ¼ grain

If the parent can be depended on to follow explicit instructions, the sedative may be administered at home. Otherwise, it is best to have the child come to the office sufficiently early that the sedative can be given; i.e., fully forty-five minutes before the dental work begins. All sedatives have the maximum effect in the second forty-five minute period following their administration. This will allow ample time for all necessary work at one sitting, before the effect of the sedative begins to wear off. In most instances, the only agent needed will be the sedative.

Analgesics.—Analgesics may be used, but as a general rule are of little value in the practice of children's dentistry.

Local Anesthetics.—There should be no hesitancy in the use of local anesthetics regardless of the age of the child. It is never necessary to inject more than 2 cc. of procaine with 1:50,000 epinephrine in order to produce anesthesia for all operative procedures. Children are quite accustomed to the hypodermic needle because of its frequent use by the physician.

A topical anesthetic should be applied to the area for one minute before the injection is made, to lessen the sensation from the insertion of the needle.

Complete anesthesia will be obtained in all upper deciduous teeth from an infiltration injection, but a tuberosity injection must be used for the upper first permanent molars.

The mandibular injection proves most successful for the lower teeth, but a peridental or interosseous injection may be used in some cases. The dentist should never be satisfied with partial anesthesia. The frequent use of local anesthetics, particularly with older children, helps to establish a happy relationship with their dentist and becomes an accepted part of their dental care. There is every reason to use this therapeutic agent to alleviate pain.

EQUIPMENT

Sharp cutting instruments, new burs and vibrationless handpieces are absolutely essential to minimize pain and decrease the amount of time necessary to complete an operation. I remember one small boy saying, "When the dentist put the buzzer in my mouth, it made every bone in my head rattle."

Warm air and a pleasant tasting mouth spray add to the pleasure of a visit to the dentist for persons of all ages. All instruments should be within easy reach of the operator at all times.

The operating chair should be tipped slightly backward so that it is comfortable for the child and, at the same time, gives the operator better visibility in the mouth.

OPERATIVE SKILL

The skill of the operator adds greatly to the possibility of reducing actual pain. This skill is not an inherited quality of a few, but comes from a thorough knowledge of the anatomy and morphology of the teeth. Applying this knowledge to the perfection of cavity preparation, in the minimum amount of time possible to produce a lasting filling, is most essential.

With adequate knowledge and proper development of one's skill in operative dentistry for children, self-confidence is developed to a high degree. This in turn is transmitted to the child. The knowledge, skill and confidence of the dentist lessens the child's apprehension and is another step in the alleviation of pain.

2940 Summit Street.

THE BIOLOGY OF CEMENTUM

By Rudolf Kronfeld, M.D., D.D.S., Chicago, Ill.

OUR present-day knowledge of the cementum is based on the findings in a number of fundamental studies made by prominent investigators. In 1887, G. V. Black published a monograph[1] on the periosteum and the peridental membrane in which he reported his findings on the cementum of the teeth of animals and man, giving special attention to cementoblasts and the continuous growth of cementum and its reparative function. In 1910, Shmamine,[2] of Tokio, wrote a monograph on secondary cementum in which he discussed in detail the minute structure of the cell-containing cementum of human teeth. After 1920, the publications of Gottlieb and his collaborators appeared. Gottlieb looks on the cementum as something more than merely a calcified outer layer on the root, considering it one of the most important structures of the tooth because it is essentially the one on which the tooth depends for its retention in the socket.

Gottlieb[3, 4] uses the term "biology of the cementum" to indicate that he is more concerned with the life processes in the cementum than with its morphology. He conceives of the "protective cementum" *(Schutzzement)* as a defensive agency of the organism against conditions which tend to weaken the support of the tooth. Gottlieb's work was directly or indirectly responsible for a vast amount of research in dentistry. Later, some of the controversies created by his publications will be given consideration.

From the Foundation for Dental Research of the Chicago College of Dental Surgery.

Read before the Section on Periodontia at the Seventy-Fourth Annual Midwinter Meeting of the Chicago Dental Society, February 15, 1938.

COMPARATIVE ANATOMY OF CEMENTUM

At this point, it might be advisable to consider comparative anatomy and to trace the cementum briefly throughout the animal kingdom. In most of the lower vertebrates, the fishes and amphibia, the teeth are in solid, bony union with the jaws, and, consequently, no cementum exists, or at least it cannot be differentiated from bone. Actual cementum appears only where teeth are no longer fused with the bone but are held in place by a periodontal membrane. This is found in certain reptiles and in all mammals. In the crocodiles and alligators, the teeth are located in individual sockets and are surrounded by a typical periodontal membrane. The root surface is covered by cementum, which contains cells and the embedded ends of the periodontal membrane fibers.

In looking on the cementum from a phylogenetic point of view, one gains the impression that this tissue has, to some extent at least, taken over some of the functions which formerly were accomplished by the continuous, rapid shedding of the teeth. In primitive dentitions, such as the polyphyodont dentition of the sharks, there is no need either for a firm attachment apparatus or for a special tissue for the repair of tooth injuries. If a tooth becomes loose, or if it is damaged, broken or dislodged, it is simply cast off, and one of the successor teeth takes its place. During the evolution of higher species, this primitive succession of teeth became less rapid, and the teeth assumed a more permanent character. Then the need apparently arose for a special tissue of retention and repair, and this tissue is the cementum. Little wonder, then, that

the cementum reaches its greatest known development in the diphyodont or monophyodont dentitions of the existing mammals.

In the teeth of mammals, the distribution of the cementum shows a great variety. In the rodents, the entire length of the incisors on the lingual side is covered with cementum. In the molars, either all of the tooth is covered or, as in the rats, only the roots. In the molars of the guinea-pig, the cementum is arranged in isolated, small areas or "pearls," alternating with areas of enamel.

In the herbivores (ungulates), the entire tooth is covered with a fairly thick layer of coronal cementum, so that dentin and enamel are exposed only on the worn occlusal surfaces. In a cross-section through the molar of a cow or a horse, the cementum appears between the folded-in portions of the enamel. In this way, cementum contributes to the formation of the masticatory surface and wears down with the enamel and dentin. A similar arrangement is found in the molars of the elephant. The cementum on the roots of these animals is laid down in thick layers.[5]

In contrast to the marked development of the cementum in the plant-eating mammals stands the relative thinness of the cementum of the meat-eaters. In the cats, dogs and bears, the cementum is confined to the roots. It is very thin, heavier layers being confined to the apical region of older animals. A section of the periodontal membrane of an adult red fox (Fig. 1) shows the thin layer of cementum to which the very strong periodontal membrane fibers are anchored.

Between these two extremes—the herbivorous dentition with thick cementum covering the entire tooth and the carnivorous dentition with thin cementum covering the root surface only—there are intermediate types. In the pig, for instance, the teeth of which represent somewhat of a transition between the herbivorous and the omnivorous dentition, the cementum extends over the cervical portion of the enamel, but does not cover the entire length of the crown as in the true herbivores.

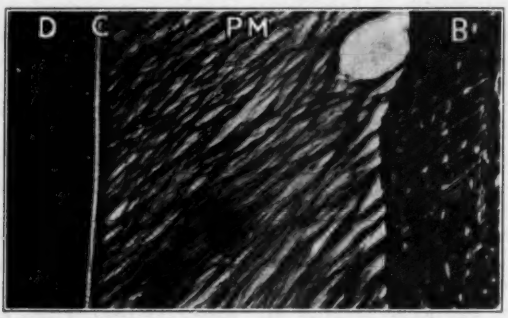

Fig. 1.—Cementum and periodontal membrane of molar of fox. The very thin cementum (C) is characteristic of the teeth of carnivorous animals. D, dentin; C, cementum; PM, periodontal membrane; B, bone. (Bielschowsky stain.)

Man, apes and monkeys, being largely omnivorous, have cementum which shows several of the characteristics of the various animal dentitions. The thin, cell-free cementum in the coronal part of the root closely resembles the cementum of the carnivores; the thick layers of cell-containing cementum at the apex and in the bifurcation of multirooted teeth are in many respects similar to the heavy cementum of the herbivores. Usually, the

crown portion of human teeth is free of cementum, except in rare instances, which will be discussed under the heading of coronal cementum.

STRUCTURE OF HUMAN CEMENTUM

The development and structure of the cementum have been described so often and are so well known that it is needless to repeat them here in detail. Briefly, cementum consists of a calcified, ground substance (matrix) and of fibrillae embedded in this matrix. The cementum covering the coronal portion of the root is free from cells (primary or cell-free cementum); that in the apical region of the root and in the bifurcation of multirooted teeth contains numerous spaces, the cementum lacunae, which harbor the cementum cells or cementum corpuscles (secondary or cell-containing cementum).

Both types of cementum are penetrated, in their superficial layers, by fibers of the periodontal membrane (Sharpey's fibers); which provides for a firm anchorage of these fiber bundles to the tooth surface.

Cementum deposition is continuous throughout life. One layer of cementum is deposited on top of the other. Usually, this is indicated by the presence of incremental lines in the cementum. In this respect, cementum differs basically from bone. Adult bone continuously undergoes a formative and a destructive process, mostly around the haversian canals; whereas cementum is laid down in layers parallel to the surface, normally without any destruction and without enclosure of blood vessels.

Fig. 2.—Apex of an upper central incisor which was subjected to lateral occlusal stress. The arrow indicates the direction of force prevalent at the apex. C_1, thin cementum on side of pressure; C_2, cementum hyperplasia on side of tension; PM_1, thin periodontal membrane on side of pressure; PM_2, thick periodontal membrane on side of tension; B, alveolar bone.

The distribution of primary and secondary cementum is subject to wide individual variations. Age plays a rôle in it inasmuch as, with advancing age, there is an increasing tendency toward the deposition of cell-containing cementum. In the repair of injuries on the root surfaces, sometimes cell-containing cementum is laid down, sometimes cell-free cementum, and sometimes both types of cementum

take part in the reparative process. On the whole, the cementum is far less constant than any other dental structure in its distribution, thickness and structural characteristics.

INFLUENCE OF FUNCTION ON DISTRIBUTION AND THICKNESS OF CEMENTUM

Because of the variability in the thickness and distribution of cementum, it is usually difficult to interpret conditions of stimulation usually have a thick cementum.

The distribution of cementum on the root end may be affected by function, unilateral cementum apposition at the apex occasionally resulting.

Small cementum protrusions and cementum spurs on the root surface are frequently arranged parallel to the direction of prevailing stresses. Such small excrescences are the result of calcifica-

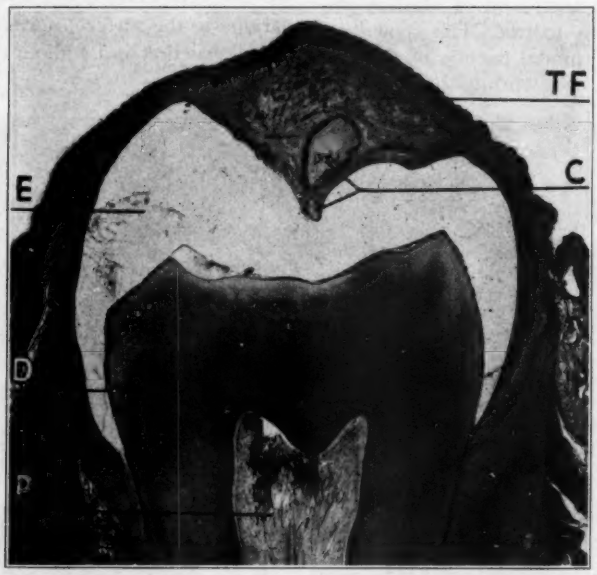

Fig. 3.—Coronal cementum on occlusal surface of unerupted lower second molar in patient aged 11 years. P, pulp; D, dentin; E, enamel space; TF, connective tissue of tooth follicle; C, coronal cementum located in the occlusal fissure.

the cementum in the light of functional factors. A few fundamental facts can be briefly stated:

Function is not necessarily a stimulating factor in cementum deposition. The few accurate data available seem to indicate that functioning teeth may have thinner cementum than corresponding non-functioning teeth in the same mouth. (Kellner.[6])

Embedded teeth, teeth in dermoid cysts and other teeth void of functional tion of periodontal membrane fibers at their point of insertion.

General hypercementosis (excementosis) usually cannot be explained by functional influences.

The thick layers of cementum frequently found on root fragments and on the roots of embedded teeth, or of extruding teeth without antagonists are considered by Gottlieb as evidence of a reparative or protective process by which Nature tends to counteract the tendency

toward occlusal displacement and, finally, elimination of such teeth or roots. I have shown that thick cementum is present in the bifurcation of molars prior to their eruption and that an apical increase in the thickness of the cementum is found in embedded teeth.[7] In both instances, the cementum hyperplasia was explained as a compensation for movement in an occlusal direction and the resultant widening of the periodontal space. This interpretation has been questioned; yet, up to this time, it seems to be the only reasonable explanation for certain established phenomena, such as the greater cementum thickness of teeth without antagonists as compared with teeth in occlusion.

The distribution of apical cementum under the influence of lateral stress is illustrated in Figure 2, showing the apex of an upper central incisor in a case of deep overbite. Because of the occlusal conditions, the apex was displaced toward the lingual side. The cementum on the lingual surface of the apex (side of pressure) is very thin; whereas it is quite thick on the labial side of the apex (side of pull). However, such a functional arrangement of the cementum is by no means a common or typical occurrence. More frequently, no clear correlation can be found between cementum distribution and kind of function.

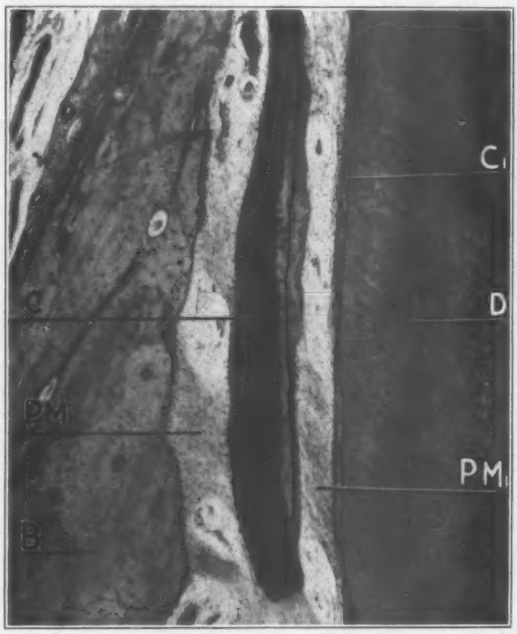

Fig. 4.—Traumatic cementum injury. A splinter of cementum (C) has been torn away from the root surface and is suspended in the periodontal membrane. Both surfaces of the splinter and the dentin surface are covered by new cementum. D, dentin; C_1, new cementum on the dentin surface; PM_1, periodontal membrane fibers between root and splinter; PM, periodontal membrane; B, alveolar bone.

CORONAL CEMENTUM

On the enamel surface of human teeth, cementum is occasionally found in two

forms: it extends from the cemento-enamel junction, for either a short or long distance, over the enamel, or it is found independent of the root cementum, over the occlusal portion of the crown.

Extensions of the cementum from the root to the crown, so-called cementum spurs, have frequently been studied and illustrated. They are of rather common occurrence and have their origin in the fact, first recorded by Meyer,[8] that the sometimes in conjunction with resorptive processes. (Worman.[9])

A slightly different picture is presented by the rare incidence of cementum on the occlusal surface of molars. Noyes[10] describes coronal cementum in the occlusal fissures of molars and compares it with the coronal cementum of the ungulates. I have found several cases in which a considerable amount of cementum was formed on the occlusal surface of teeth prior to their eruption.[11] Some of this

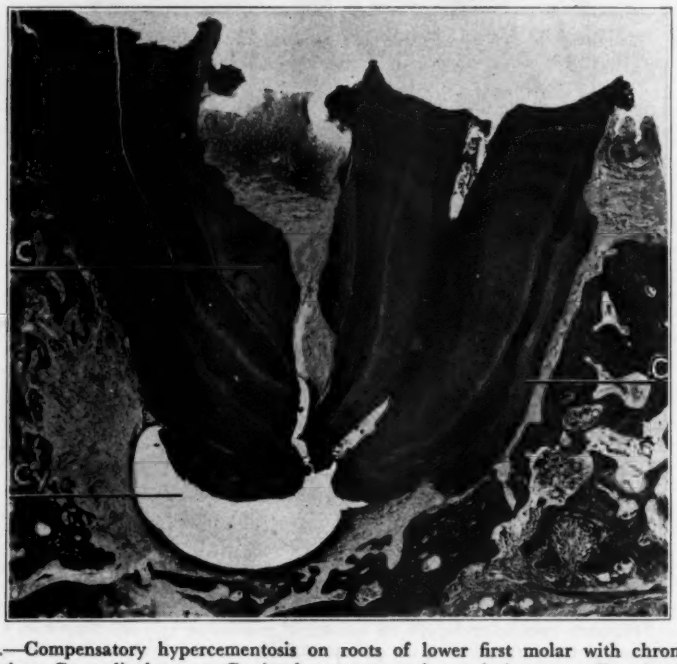

Fig. 5.—Compensatory hypercementosis on roots of lower first molar with chronic apical inflammation. Cy, radicular cyst; C, circular cementum hyperplasia surrounding the roots.

enamel epithelium next to the cemento-enamel junction is often missing. In these areas, during eruption, the connective tissue comes in contact with the enamel surface, and cementum is deposited on the enamel. Embedded teeth offer an opportunity for a prolonged contact between enamel and connective tissue. Thus, extensive cementum deposits are observed on the enamel of such teeth, cementum is located in the occlusal fissures, where Noyes found it later in erupted teeth; other cementum formations appear to be lying free in the connective tissue of the tooth follicle and are, therefore, lost when the tooth erupts.

The deposition of cementum upon the enamel surface of a tooth is a slow process. It probably takes several years for the enamel epithelium to become

atrophic, and again years until a considerable amount of cementum is formed on the exposed enamel. The best opportunity for such a process is offered by fully embedded teeth, which often lie dormant in the jaws for a period of thirty or forty years. In such teeth, coronal cementum in large quantities has repeatedly been reported. (Kotanyi.[12])

In normally erupted teeth, there is less likelihood of cementum deposition because of the relatively short time interval between completion of amelogenesis and eruption; yet such cementum deposition has occasionally been observed in sections through unerupted permanent molars of young children. Particularly in one instance, in the lower second permanent molars of a child of 11 years, coronal cementum was found in the bottom of the fissures in contact with the enamel, and free cementum bodies (cementicles) were located in the tooth follicle over the occlusal surface. (Fig. 3.) After eruption, the free cementicles are lost; however, the coronal cementum in the occlusal fissure remains, except for its most prominent portion, which is probably soon worn off by mastication.

REPARATIVE FUNCTION OF CEMENTUM

One of the most important functions of cementum is the repair of injuries to the root surface. It has been contended that it is incorrect to speak of a "reparative function of the cementum," that, rather, one should say "reparative function of the periodontal membrane." To this, I should like to make the following comment: It is granted that the acting tissue in the repair of damages to the root surface is the connective tissue of the periodontal membrane; yet the only way of recognizing and evaluating the reparative properties of the periodontal membrane is by the extent of cementum deposition. The cementum here plays the same rôle that a callus plays in the repair of bone injuries: the repairing tissue is the connective tissue of the periosteum and the endosteum, but the actual mechanical repair is performed by the new bone substance laid down in the injured area.

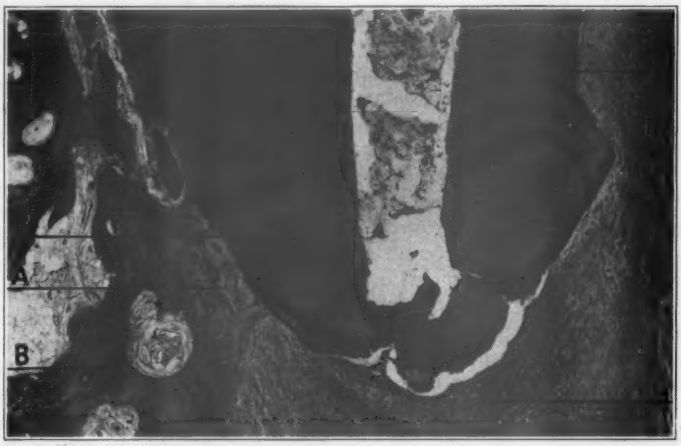

Fig. 6.—Ankylosis (bony union) between root and bone from chronic periapical inflammation. G, granuloma at apex; R, resorption of dentin; A, bridge of bone extending from alveolar process to dentin; B, alveolar bone.

The causes for resorptive processes on the cementum surface are manifold. They will be enumerated and considered briefly and their clinical significance will be emphasized. Generally, the causes can be grouped in three large categories: (1) pressure and mechanical trauma, (2) inflammation and (3) systemic causes.

PRESSURE AND TRAUMA AS CAUSES OF CEMENTUM RESORPTION

Any occlusal force that exceeds the tensile strength of the suspensory apparatus of the tooth may cause resorption of the cementum. Emphasis is laid upon the word *may*, since there appear to be wide individual variations in the susceptibility of different teeth to cementum resorption. From the histologic examination of human teeth which were subjected to excessive and unfavorable occlusal stresses, the result of such stresses is known: circumscribed, shallow areas of cementum resorption, located in the area of the root surface nearest the center of action of the force. (Orban,[13] Cooldige.[14]) Usually, these resorbed areas are partly or completely covered over by newly laid down cementum. This indicates that such resorption has no tendency to become progressive and perhaps to destroy a large portion of the root; on the contrary, there is a very marked reparatory tendency, and as soon as the pressure is diminished or discontinued by a shift in occlusion, new cementum is laid down in the resorbed area.

Of particular interest are the recent observations of human teeth that were subjected to orthodontic movement. (Stuteville.[15]) It seems that it is impossible to move a tooth by means of any kind of orthodontic appliance without causing at least some small, shallow areas of resorption on the pressure side of the root. At least, all such teeth thus far examined microscopically have shown these defects. However, because of the high reparative power of young periodontal tissue, repair always takes place, and therefore shallow orthodontic resorption can be considered as of no practical significance, merely indicating that the force applied exceeded the biologic limits of tissue tolerance. Such a procedure, however, is apparently necessary to attain the desired clinical result and, therefore, is justified.

These superficial areas of resorption caused by orthodontic tooth movement must not be confused with the type of extensive root resorption occasionally observed with or without orthodontic treatment. Such resorption falls under category 3 (systemic causes) and will be dealt with under that heading.

Other forms of pressure which often cause extensive resorption of cementum and dentin are clinically well known. The pressure of the growing and advancing permanent tooth germs causes root resorption in the deciduous teeth. An embedded tooth may exert pressure on the root of an adjacent tooth and cause resorption of the latter. Tumors and cysts of the jaw likewise cause pressure resorption of the cementum and dentin of the root. Especially, malignant tumors may destroy the roots of several adjacent teeth within a relatively short time. But all of these resorptive processes have one thing in common: As soon as the cause is removed and the pressure has ceased, new cementum is laid down on the resorbed surface, no matter whether it is enamel, dentin or cementum, and an attempt is made by the organism to establish a workable functional relationship between tooth and bone.

Traumatic injuries to the root surface may be brought about by heavy biting on hard objects, especially when the connection between the teeth and the alveolar process has previously been weakened by pyorrhea, and by blows, kicks or other forces originating outside the mouth. These injuries may, on rare oc-

casions, lead to extensive resorption of the root. More commonly, the root is fractured, usually in its thinner, apical portion or near the cemento-enamel junction.[16] In favorable cases, the pulp remains vital, and the fractured ends become covered with cementum, or the fragments may be united by a callus consisting of cementum and irregular dentin.

Besides complete cross-fracture of the root, there occur minute infractions of the root surface. The mechanism of such a *Rissfraktur,* as the German writers call it, is analogous to that type of bone fracture in which a piece of bone is torn away at the point of attachment of a strong tendon. The attachment of the periodontal membrane fiber bundles to the cementum is stronger than the attachment of the latter to the dentin, and, as a result, pieces of cementum are torn off at the dentinocemental junction. (Coolidge.[14]) The way in which such cementum splinters are gradually recovered by layers of new cementum makes comprehensible the reparative mechanism following injury to the root surface. (Fig. 4.) The original cementum surface is not noticeably altered, but both the under surface of the cementum splinter and the outer surface of the dentin are covered by new cementum. If the splinter is very close to the root surface, or if it has been only partly detached, it may be reunited with the root. If it is located farther from the area of fracture, periodontal membrane fibers form between root and splinter, and the latter lies free between tooth and bone, almost like a sesamoid bone.

INFLAMMATION AS CAUSE OF CEMENTUM RESORPTION

Inflammatory processes in the periodontal tissues are frequently accompanied by resorptive changes in the cementum. This is far more often true of periapical inflammation than of marginal inflammation. Even in extensive and prolonged gingivitis and pyorrhea, cementum resorption is rare and usually very limited. Periapical inflammation, on the other hand, almost invariably leads to some resorption of the root surface, and occasionally to extensive destruction of the apex.

Teeth with granulomas or radicular cysts show a varying amount of cementum resorption, depending on the course of the inflammatory process. In these cases, the cementum must have been resorbed in the early phases of the inflammatory process, for once the apical periodontal membrane is detached from the root surface and an abscess cavity or cyst has been formed at the apex, no more resorption of that particular area of root surface is possible.

If the inflammatory process remains stationary for a period of many years, a circular cementum hyperplasia often develops just above the involved portion of the root. This form of hypercementosis may be interpreted as an attempt on the part of the periodontal membrane to compensate for the apical loss of periodontal attachment by an enlargement of the area of attachment with newly embedded periodontal membrane fibers just beyond the line of destruction. (Fig 5.) Gottlieb's early studies of the *Schutzzement* (protective cementum) were made on specimens of nearly exfoliated root fragments. These fragments which were attached on only one surface illustrated the function of hypercementosis as a means of holding the root in place and counteracting conditions tending toward its elimination.

If the apical inflammation subsides, the resorbed areas of the root surface may be covered over partly or completely with new cementum. This is of great practical importance in root-canal therapy. Any surgical or medical interference with the pulp or the root canal causes a certain amount of reactive inflammation

of the apical periodontal membrane and shallow resorption of the cementum surface. If the tooth was previously infected, resorption will be particularly pronounced. After the initial reaction to the removal of the pulp has subsided, or after the infection in the root canal has been eliminated, new cementum is deposited on the apical root surface, and the areas of resorption are repaired. The ultimate outcome of any root-canal treatment or root amputation is determined by the reaction of the apical periodontal tissues. If these tissues are capable of laying down cementum, eventually the apical foramen is completely closed by cementum. This condition is considered the ultimate indication of successful root-canal therapy.

SYSTEMIC DISTURBANCES AS CAUSE OF CEMENTUM RESORPTION

A few well-observed, rather startling cases of generalized cementum resorption apparently of systemic origin have been reported. (Mueller.[17]) It seems that, for some reason, the cementum may become extremely susceptible to resorption, so that a minute injury, or even normal function, causes extensive resorption of the root. If we use Gottlieb's terms, we might say that the vitality of the cementum has been lowered. No new layers of cementum are deposited, the cementum surface being resorbed instead.

When the attention of the profession was first called to the possibility of such extensive root resorption in young persons, largely by the publications of Ketcham, it was at first believed that orthodontic treatment was responsible. More recent investigations suggest that root resorption may be found as often in persons who have never undergone orthodontic treatment as in those who have. Perhaps the condition is related to a deficiency in the function of the thyroid gland. (Becks.[18]) Other cases of generalized destructive cementum resorption, such as the one reported by Mueller, are entirely obscure as to etiology. With the possible exception of the above-mentioned data of Becks, we know today of no single factor, dietary or otherwise, which in human beings would alter the susceptibility of the cementum to resorption.

ANKYLOSIS OF TOOTH AND BONE

In the course of repair of extensive areas of cementum resorption, a solid, bony union between root and alveolar process may develop. This is quite rare. Among a large number of specimens of human teeth with infected root canals examined *in situ,* only one of extensive bony union was observed. (Fig. 6.) The possibility of bony ankylosis leads to the discussion of one of the least understood problems in the biology of cementum; namely, the question why bony union does not occur more often. The conditions necessary for such a union are certainly present. Bone and cementum are structurally closely related. The two tissues are always in close proximity. The movements of the teeth in function may have something to do with preventing ankylosis, but, again, root apices that remain embedded in the jaw for decades show no tendency to become ankylosed.

Attention should be called here to the fact that replanted teeth are invariably resorbed and subsequently become ankylosed, regardless of the functional conditions. This well-known clinical observation possibly helps to explain the antagonism between cementum and bone. Apparently, cementum has a strong natural tendency to remain separated from bone, even if the two tissues are in close proximity and their relationship is entirely undisturbed, as with embedded teeth or root fragments. Extraction and replantation overcome this antagonism between cementum and bone. Extensive resorption of the cementum takes place, and bony union ensues.

SUMMARY

1. The distribution of cementum throughout the animal kingdom varies greatly among the various species. Generally, the herbivores have thick cementum and the carnivores thin cementum. Man occupies an intermediate position.

2. The basic biologic difference between cementum and bone is that cementum is normally deposited continuously without resorption; whereas, in bone, deposition and resorption occur simultaneously throughout life.

3. Teeth in occlusion usually have thinner cementum than teeth without antagonists and embedded teeth. Occasionally, cementum is distributed on the root surface in accordance with prevailing functional stress.

4. Cementum deposition upon the enamel (coronal cementum) is frequently found in embedded teeth. Sometimes, it also occurs in the occlusal fissures of normal, unerupted teeth of children.

5. Resorptive processes on the root surface are usually offset by cementum deposition. Such resorption may be caused by trauma, pressure, inflammation or systemic disturbances.

6. On rare occasions, a bony union (ankylosis) between alveolar process and root develops during formation of the reparative cementum following root resorption.

BIBLIOGRAPHY

1. Black, G. V.: Periosteum and Peridental Membrane. Chicago: W. T. Keener, 1887.

2. Shmamine, T.: Das sekundäre Zement (The Secondary Cementum). *Deutsche. Zahnheilk. in Vortäg.*, No. 13, G. Thieme, Leipsic, 1910.

3. Gottlieb, Bernhard: Zur Atiologie und Therapie der Alveolarpyorrhoe (Etiology and Therapy of Pyorrhea Alveolaris). *Ztschr. f. Stomatol.*, 18:59, January 1920.

4. Gottlieb, Bernhard: Histologische Befunde an umgelegten Wurzeln (Histologic Findings on Tilted Roots). *Ztschr. f. Stomatol.*, 19:1, January 1921.

5. Kronfeld, Rudolf: Zement und Sharpeysche Fasern (Cementum and Sharpey's Fibers). *Ztschr. f. Stomatol.*, 26:714, July 1928.

6. Kellner, E.: Das Verhältnis der Zement- und Periodontalbreiten zur funktionellen Beanspruchung der Zähne (Relationship of Thickness of Cementum and Periodontal Membrane to Function). *Ztschr. f. Stomatol.*, 29:44, January 1931.

7. Kronfeld, Rudolf: Die Zementhyperplasien an nicht functionierenden Zähnen (Cementum Hyperplasia in Non-Functioning Teeth). *Ztsch. f. Stomatol.*, 25:1218, December 1927.

8. Meyer, Wilhelm: Neue Befunde am Epithelansatz (New Findings on the Epithelial Attachment). *Ztschr. f. Stomatol.*, 28:775, August 1930.

9. Worman, H. G.: Histopathologic Study of Impacted Teeth. J.A.D.A., 16:1885, October 1929.

10. Noyes, F. B.: Dental Histology and Embryology. Philadelphia: Lea & Febiger, 1929.

11. Kronfeld, Rudolf: Coronal Cementum and Coronel Resorption. *J. D. Res.*, to be published.

12. Kotanyi, E.: Histologische Befunde an retinierten Zähnen (Histologic Findings in Embedded Teeth). *Ztschr. f. Stomatol.*, 22: 747, November 1924.

13. Orban, Balint: Tissue Changes in Traumatic Occlusion. J.A.D.A., 15:2090, November 1928.

14. Coolidge, E. D.: Traumatic and Functional Injuries Occurring in Supporting Tissues of Human Teeth. J.A.D.A., 25:343, March 1938.

15. Stuteville, O. H.: Injuries of Teeth and Supporting Structures Caused by Various Orthodontic Appliances and Methods of Preventing These Injuries. J.A.D.A., 24:1494, September 1937. Injuries Caused by Orthodontic Forces and Ultimate Results of These Injuries. *Am. J. Orthodontics*, 24:103, February 1938.

16. Kronfeld, Rudolf: Case of Tooth Fracture, with Special Emphasis on Tissue Repair and Adaptation Following Traumatic Injury. *J. D. Res.*, 15:429, December 1936.

17. Mueller, Emil: Histologic Study of Case of Extensive Root Resorption in Human Being. J.A.D.A., 18:684, April 1931.

18. Becks, Hermann: Root Resorptions and Their Relation to Pathologic Bone Formation. *Internat. J. Orthodontia*, 22:445, May 1936.

DENTAL SURGERY AND ENDOCARDITIS

By William F. Petersen, M.D., and A. J. Nedzel, M.D., Chicago, Ill.

Reith and Squier[1] have shown that bacteremia may exist in apparently healthy persons and yet the localization of micro-organisms, which may lead to different infectious processes, is relatively rare. Oral manipulation, particularly tooth extraction, no doubt, is quite often accompanied by a bacteremia. There is considerable clinical evidence that such oral manipulation may be followed by endocarditis. To understand the mechanism, we must try to analyze the conditioning factors in the localization of micro-organisms on the heart valve.

In determining the functional status of endothelial permeability day by day in individual cases, it was found by one of us[2] that the functional state varies. The organism as a whole swings through its regular, or irregular, phase difference, which is designated ARS (anabolism, reduction, spasm), to COD (catabolism, oxidation, dilatation), and vice versa, and the endothelium becomes more permeable during the COD phase and less permeable during the ARS phase. The ARS phase involves a blood pressure increase, and the greater this is, the greater the effect of chemical stimulation in certain parts of the endothelium and the greater the possibility for anoxic conditions in certain portions of the organism. With periods of anoxic stimulation or after mechanical stimulation, the endothelium not only becomes more permeable, but also becomes sticky—a physicochemical change that involves changes in the electrical charge, etc.

These phase changes may be initiated by many general conditions (endocrine, nutritive, toxic), but are most commonly associated with swings in biologic rhythm that are set up by the effort of the organism to adapt itself to the shifts in the atmosphere (heat, cold, pressure changes, etc.).

Incidentally to this changing rhythm of the ARS and COD phases, the blood pressure relations of the vascular system are altered. Periods of high blood pressure (ARS phase—spasm) are followed by periods of low blood pressure (COD phase).

The increase in pressure means more work for the left side of the heart; the right will not be affected to any great extent. The margins of the aortic and mitral valves impinge on each other more forcibly, and, as a consequence, the marginal endothelium in the region of contact is mechanically stimulated to a greater degree and becomes selectively more adhesive.

There are, however, coincident changes in the vessels of the valves. One ordinarily disregards them, but injection of pitressin (betahypophamine), which produces a response in pressure, frequently is followed by a hemorrhage into the leaflets of the valves, and even ordinary pressor episodes are probably associated with considerable nutritive change in the tissue of the valves.

The foregoing suggests that vasomotor instability, with its greater pressor peaks, may have a direct influence on, if it is not the real background for, the development of endocarditis.

What do we find experimentally? Arti-

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Read before the Section on Medical Relations at the Seventy-Fourth Annual Midwinter Meeting of the Chicago Dental Society, February 16, 1938.

ficially induced pressor episodes (obtained with intravenous pitressin injection) in dogs cause mechanical stimulation of the endothelial cells of the cardiac valves, particularly those at the contact surface of the mitral valve.

Histologically, we find that the endothelial nuclei change their form and position. They undergo hydration and finally disintegrate. The cytoplasm swells and becomes vacuolated. The endothelial surfaces become mucoid and stringy. Some of the endothelial cells degenerate in such a way that long protoplasmic streamers may extend far into the blood stream. Cell surfaces so altered present an ideal condition for localization of bacteria present in the blood stream. Microorganisms of endogenous origin may be observed localizing on endothelium.

Although an artificial pressor episode has been dealt with here, it is obvious that the spontaneous occurrence can act in conditioning the endothelial surface by bringing about greater adhesiveness. The pressor episode thus becomes of significance for the initiation of true endocarditis.

If it is true that the endothelium becomes adhesive (sticky) and that the implantation of endogenous bacteria from the blood stream is not a matter of chance, the greater frequency of invasion of the blood stream and simultaneous change in the function of tissues receiving the bacteria, and not specific selectivity on the part of the invading organism, is of importance. The microorganism may be relegated to the background and the conditioning factors in its localization may be emphasized.

The experiments substantiate these assumptions. Dogs were given an intravenous injection of pitressin, followed in fifteen minutes by an injection (also intravenous) of a suspension of bacteria or of India ink. The bacteria used were *Staphylococcus aureus* and *Streptococcus hemolyticus.*

The experimental material (Nedzel[3]) reveals the early implantation of bacteria on the valvular surface (first a few micro-organisms on the outer layer of the valve, then a mass of bacteria) and their gradual invasion of the stroma of the valve. The change in the endothelial cells due to pressor episodes is to be correlated with the bacterial implantation. The bacteria infect the valves not because of selective properties, but, like any other particulate foreign matter, because of the adhesiveness of the damaged valvular endothelium; for particles of India ink are also picked up by such endothelium. Ultimately, ulcerative lesions with the gross and microscopic appearance seen clinically in endocarditis can be obtained. In some cases, repeated injection of pitressin (without injection of bacteria) led ultimately to the development of bacterial endocarditis, the bacteria being of endogenous origin.

The experimental results substantiate previous assumptions that the pressor episodes cause undue stimulation of the endothelium (in the present case, the valvular, especially the mitral, endothelium). The stimulation is accompanied and followed by changes whereby the endothelium becomes sticky and permeable. This stickiness and permeability permit the bacteria casually present in the blood stream to localize on the valves, with corresponding consequences.

The vast majority of positive results were observed in late winter and spring, although the work was carried on under the same circumstances and with the same technic all the year round.

The animals, which were approximately of the same age and weight, in good health and kept in the same institution, had the same diet through the year; and yet their reactions to the same amounts of pitressin, given in the same way, showed great variance. In the summer and early fall, they showed scarcely any reaction toward the injection of pitressin. A slight diarrhea of short duration and salivation were the symptoms in

a vast majority of the cases. Some of the dogs did not react at all.

In the late fall and early winter, about 50 per cent of the animals showed the effects of pressor episodes with well pronounced immediate reactions to the injections (severe diarrhea, profuse salivation and vomiting). Some of the animals were prostrated for a long time (up to twenty-four hours).

Late winter and spring were the most favorable times for experimentation. Then, all the animals responded to the injections of pitressin, often violently. Eighty per cent of them showed some pathologic change, especially on the heart valves (mostly on the mitral valves), the object of these studies. Not uncommonly, the injection of a dose of pitressin (usually well tolerated in summer) caused the death of an animal immediately or in a few hours after the injection. Necropsy revealed great congestion of the heart, and pallor and anemia of the visible mucous membranes and gastro-intestinal tract.

From these observations of the reactions of dogs in connection with season, one may also conclude that the change in the endothelium, which is necessary for the onset and development of endocarditis, is dual in origin, being partly the effect of a pressor episode (due to mechanical stimulation) and, very likely, partly the effect of systemic stimulation associated with season.

The endothelial cells apparently become adhesive. While some of the surface cells to which bacteria adhere may be proliferated mesenchymal elements from subendothelial tissue, it is clear that one can demonstrate histologically changes associated with stimulation (fatigue and necrosis) and adhesiveness as a preliminary stage to bacterial localization.

Our experimental findings substantiate previous clinical observations[4] that, in man, in the late winter and spring, the endothelium in general is more permeable (stimulated); whereas, in summer and autumn, the endothelium is less permeable. For the present problem, this means that, other conditions being equal, the chance for bacterial adhesion is in general increased in the late winter and spring and that during the summer and autumn the possibilities for adhesion are lessened.

Our observations lead us to the following conclusions:

1. Oral manipulations, especially tooth extraction, presenting an opportunity for blood invasion by bacteria, should be carefully considered from the point of seasonal and meteorologic environment.

2. Winter and spring are associated with increased risk in comparison with the summer and fall, for during the late winter and spring the patient is "conditioned" or "sensitized" for bacterial localization in certain regions, especially if he is of a slender type, with a vascular instability.

3. Clinical and experimental evidence definitely point to endothelial changes in the heart valves (especially of the left side) which make them "sticky," and therefore favorable for bacterial localization. These changes are definitely connected with the seasons and pressor episodes, and the appearance of bacteria in the blood at this time may lead to the development of bacterial endocarditis.

BIBLIOGRAPHY

1. Reith, A. F., and Squier, T. L.: *J. Infect. Dis.*, 51:336, September-October 1932.

2. Petersen, W. F.: Patient and Weather, Vol. I, Part. 2, Chap. 4. Ann Arbor, Mich.: Edward Bros., 1936.

3. Nedzel, A. J.: Patient and Weather, Vol. IV, Part 1. Ann Arbor, Mich.: Edward Bros., 1934, p. 649.

4. Petersen, W. F.: Patient and Weather, Vol. II. Ann. Arbor, Mich.: Edward Bros., 1934, p. 501; Vol. IV, Part 1, 1937, p. 545.

VINETHENE: ITS USE IN THE DENTAL OFFICE

A STUDY OF ONE HUNDRED CASES

By Peter A. Rosamilia, D.D.S., Newark, N. J.

VINETHENE, sometimes called vinyl ether, divinyl ether or divinyl oxide, is a clear, colorless liquid with a distinctive odor. It is highly volatile and boils at about 85° F. It is inflammable and explosive. Pure vinyl ether $(CH_2:CH)_2O$, plus absolute alcohol and an oxidation inhibitor, is marketed under the name vinethene. Exposed to light and air, it deteriorates rapidly. In an open bottle, it loses its potency in from twenty-four to thirty hours. It is especially indicated for anesthesia during short intervals. Other characteristics of vinethene are rapid induction and prompt recovery as well as rapid and effective relaxation. Its administration is facilitated by the fact that special equipment is not required.

Used alone or as an adjunct to other anesthetics, vinethene has an almost unlimited field of usefulness. It has been used successfully in the fields of ophthalmology, otolaryngology, abdominal surgery and oral surgery, and particularly in obstetrics; for tonsillectomies, turbinectomies and circumcisions, and for the extraction of teeth. It has been used alone or with oxygen, or added to ether, ethylene or nitrous oxide-oxygen. There is general agreement that vinethene is a very potent anesthetic. Tucker[1] says: "Vinethene may be more safe than some of the widely used anesthetic agents, but it is a very powerful drug . . . the safety factor still largely depends upon the ability and experience of the anesthetist." Light, Ross and Fulton[2] report that vinethene induction is similar to that of nitrous oxide or ethylene and that it has no cumulative effect. Ravdin and his collaborators[3] say: "Rapidity of recovery . . . implies that it is rapidly removed from the body and provides a safety factor of no mean importance in so potent an agent." Most authorities are agreed that vinethene offers quick onset, satisfactory relaxation and swift recovery with little or no postoperative discomfort. Complications such as nausea, vomiting or violence were reported in rare instances. Vinethene is contraindicated in cardiac and hepatic conditions.

Because of its properties, vinethene seems to be especially indicated for short dental operations. This report is concerned with an investigation of the possibilities of vinethene for dental office use, especially in children.

METHODS

This study involves 100 cases in which vinethene was used alone. Because of the precautionary nature of the literature on the subject, no premedication was used, no attempt was made to obtain prolonged anesthesia and the stopwatch technic was deferred until the fifty-fifth case. The findings in the forty-five cases measured by the stopwatch, however, were representative of the 100 cases in general. All of the cases fell within the 4-16 age group, seventy-three patients being between 6 and 11, probably the age group most difficult to manage. The open drop method of administration was used, as demonstrated by Beach, Gunter and Thompson at the University of Pennsylvania Alumni Day Clinic in May 1935. With this method, three or four

thicknesses of 6 by 6 inch sanitary gauze are placed over the bridge of the nose, and the vinethene is allowed to drop, the rising vapors causing anesthesia. The target is the upper lip. The patient sits in the chair in a semirecumbent position with the left arm raised at a 45 degree angle. As the arm descends, anesthesia commences; when it lies relaxed in the lap, the operator may begin. The induction period, which is without violence or excitement, is very short. An operator, finding it difficult to maintain an even level or a prolonged anesthesia, might be tempted to increase the rate at which vinethene is allowed to drop; but such a procedure involves the possibility of dangerous overdosage. Fifty to 75 drops a minute is an optimum rate. The tendency should be toward the 50 rather than 75. With too great a concentration, vinethene sometimes "freezes," taking the appearance on the gauze of the "frost" of a vanilla ice cream soda. This prevents the passage of sufficient air for dilution.

RESULTS

Children, probably because of the absence of mask and cumbersome equipment, approach administration without fear.

It was observed that vinethene is not harmful to the skin or to the mucous membranes of the eyes, nose or mouth. The eye signs are unreliable indexes of anesthesia: the eyes may readily water, or the pupils may dilate or contract in the same manner as with other anesthetic agents, but the eyeballs may roll rapidly, stay fixed, stare or "cock" toward or away from the bridge of the nose. The eyelids may blink even during an anesthesia deep enough for extraction of teeth. None of these signs is significant. Respiration offers the safest sign: it is always faster than with other inhalation anesthetics, but never deep. Stertorous breathing was never observed. There was very little change in color. Occasionally, in light complexioned patients, slight flushing of the forehead or of the cheeks was seen. Cyanosis never appeared. Most cases showed an increased flow of saliva.

The induction period was short. It took an average of 6 to 10 cc. of vinethene to induce anesthesia, depending on whether the gauze was used dry or was wet with water or with vinethene before induction began. Dampening with either water or vinethene shortens the induction time. The fastest induction, forty-four seconds, was obtained in a 10-year-old boy; the longest, four minutes and twenty-five seconds, was likewise obtained in a 10-year-old boy. The average was one minute and fifty-nine seconds. There appeared to be no relationship between the age of the patient and the amount of vinethene used to produce anesthesia. The quickest recovery time was twenty seconds, in a 10-year-old boy; the longest, four minutes and thirty-seven seconds, in a 9-year-old girl. The average recovery time was one minute and nineteen seconds. These were among the forty-five cases

RESULTS OBTAINED WITH VINETHENE ANESTHESIA FOR DENTAL OPERATIONS IN CHILDREN

	Number of Cases	Time Seconds
Induction in the forty-five cases for which stop-watch data were collected	11	44– 60
	15	61–120
	9	121–180
	6	181–240
	4	241–265
	Average 119	
Recovery in same forty-five cases	20	20– 60
	17	61–120
	6	121–180
	1	181–240
	1	241–277
	Average 79	
Untoward results:		
Excitement	3 cases	
Anesthesia not successful	1 case	

timed by the stopwatch. The findings in the forty-five cases for which stopwatch data were collected are given in greater detail in the accompanying table.

It did not necessarily follow that the slowest induction was attended by the slowest recovery or the fastest induction by the fastest recovery.

Most of these patients were anesthetized with vinethene for the extraction of deciduous or permanent teeth; but there were a few cases of cavity preparation and a few of incision and drainage of abscesses. Throughout the series, vinethene gave satisfactory relaxation. Nausea, vomiting and violence were absent. Excitement, largely characterized by arching or struggling, was observed in four cases, one of which it was found inexpedient to finish.

CONCLUSIONS

Certain disadvantages attend the use of vinethene. It is difficult to maintain the level of anesthesia, the transition to deep anesthesia is swift and the anesthetic signs are indistinct. Without premedication, there is an increased flow of saliva. Vinethene undergoes a loss of potency when exposed to light and air.

Nevertheless, and although it cannot displace nitrous oxide, vinethene should have a very definite place in dentistry because of the simplicity of administration and rapid induction and the quiet and swift recovery of the patient. For children, it is especially indicated because in them it produces better relaxation than nitrous oxide. They approach anesthesia with a minimum of fear. There is no postoperative discomfort.

It is true, as Gunter, Beach and Looby[4] hold, that any one familiar with ether or nitrous oxide can use vinethene. These authors properly stress the fact that vinethene permits of no lost time or motion. Its use requires more than ordinary diligence and perfunctory care: it demands intense application and extreme care. If these requirements are strictly observed, it can be used with safety and to advantage in the dental office.

BIBLIOGRAPHY

1. Tucker, E. B.: Observation on Use of Newer Anesthetics: Vinethene and Cyclopropane. *Anesth. & Analg.*, 16:55-59, January-February 1937.

2. Light, G.; Ross, M. A., and Fulton, E.: Clinical Experience with Divinyl Ether (Vinethene). *Anesth. & Analg.*, 16:167-170, May-June 1937.

3. Ravdin, I. S., et al.: Divinyl Ether. Report of Its Further Use as General Anesthesia. *J.A.M.A.*, 108:1163-1167, April 3, 1937.

4. Gunter, J. H.; Beach, E. W., and Looby, J. P.: Use of Vinyl Ether as Dental Anesthetic. *Internat. J. Orthodon.*, 22:746-750, July 1936.

5. Present Status of Vinethene. Report of Council on Pharmacy and Chemistry. *J.A.M.A.*, 109:656-658, August 28, 1937.

6. Cook, T. S.: Vinethene as Dental Anesthetic. *J. D. Res.*, 16:344, August 1937.

7. Ramage, G.: Vinyl Ether Anesthesia in County Dental Clinics. *M. Officer*, 57:45-46, January 30, 1937.

64 North Tenth Street.

THE JOURNAL *of the* AMERICAN DENTAL ASSOCIATION *and* THE DENTAL COSMOS*

C. N. JOHNSON, Editor**

L. PIERCE ANTHONY, Associate Editor

Published by the American Dental Association

212 East Superior St., Chicago, Ill.

All expressions of opinions and all statements of supposed facts are published on the authority of the writer over whose signature they appear, and are not to be regarded as expressing the views of the American Dental Association, unless such statements or opinions have been adopted by the Association.

Communications intended for publication in the scientific or literary pages of THE JOURNAL should be addressed to the Editor. All advertising or business matter should be sent to the Business Manager.

Subscription is included in the annual membership dues. The subscription rate to non-members is $5.00 a year in advance, this rate applying to both domestic and foreign subscriptions. All foreign subscriptions are to be paid in United States money.

*In deference to the wish of the dental profession to control its literature, *The Dental Cosmos*, founded in 1859, was transferred by the publishers as a gift to the American Dental Association, January 1937.

**Deceased.

Editorial Department

HEALTH SERVICE AND SOCIAL SECURITY

ONE of the results of the interest that has been aroused in the part which health service should play in an administration that is definitely committed to the policy of social security is the appointment by President Roosevelt in August 1935 of a Committee to Coordinate Health and Welfare Activities, comprising representatives from five federal departments and agencies, under the chairmanship of Miss Josephine Roche.

With the aid of technical experts in the various bureaus of these departments, the committee conducted an extensive study of the needs and problems of public health service and medical care in this country, and in March of this year reported its findings to President Roosevelt. The President immediately suggested to the chairman of the "committee give consideration to the desirability of inviting representatives of

the interested public and of the medical and other professions, to examine the health problems in all their major aspects and to discuss ways and means of dealing with these problems." Accordingly, the chairman, Miss Roche, called the National Health Conference for July 18 to 20, 1938, for the purpose of (1) presenting and discussing the needs of the people of this country for preventive and curative service in illness and for the reduction of the economic burdens caused by illness, as revealed by governmental and other studies; and (2) to discuss steps which may be taken to meet these needs, as proposed by representatives of the Government and by members of the conference.

Public spirited citizens, representing leaders in the fields of medicine, labor, the farm, social work and civic affairs, were invited to and did attend the conference. Dentistry was well represented by the President of the American Dental Association, C. Willard Camalier, Washington, D. C.; J. Ben Robinson, Baltimore, Md.; Herbert E. Phillips, Chicago, Ill., and Lon W. Morrey, Chicago, Ill., as members, and Frank C. Cady, United States Public Health Service, Washington, D. C., as an observer, and Edward J. Ryan, Evanston, Ill., as a member of the press. Altogether, about three hundred persons, representing practically all professional, social, industrial and welfare interests, took part in the conference, and the opinions expressed and the discussions offered should and no doubt will exert a definite influence upon any plan or program projected and prosecuted by the Government in an effort to carry out its apparent intention to socialize health service as a part of the general plan of social security.

As a study of the personnel of the conference would give some idea as to the importance attributed to this Administration activity, we should like to present a roster of the personnel of the conference, but lack of space forbids. Suffice it to say that practically every professional, civic, social, philanthropic, welfare, labor and agricultural interest was there represented, and the spirit of determination to increase the government's responsibility in health care was apparently unanimous in response to the three days' emotional appeal from labor, farm and social leaders for alleviation of the need of health care for the people. Included among the speakers, besides those listed on the program, were leaders in almost every field—miners, steel workers, automobile workers, clothing workers, farmers, social workers, physicians, dentists, nurses and hospital representatives.

The National Health Conference is the latest and surely the most posi-

tive movement toward the inauguration of plans for health security that will include those who are on relief and those in the lower salary levels, the first step being the White House Conference on Child Health and Protection, called by President Hoover in 1931, which was presided over by Professor Ray Lyman Wilbur, and which directed its attention to consideration of ways and means of more adequately providing health facilities for the nation. The second was the national survey of the Committee on Costs of Medical Care, undertaken to form the basis of a program that would relieve the pressure of the high costs of medical care on all classes; the third, the publication of "American Medicine," by The American Foundation, which reported the findings of a survey of the facilities of medicine, undertaken to gather information upon which to base a program that would provide adequate medical service to all classes; not an official survey, but sponsored by civic and governmental agencies and a large group of the medical profession—all of these special movements directed, as it now appears, to one objective, socialized medicine.

As an aftermath of the health conference, or, more likely, coincidental therewith, the recent action of Assistant Attorney General Arnold, in threatening suit against the American Medical Association for violation of the Anti-Trust Law, is somewhat disconcerting, and although we do not believe that the threat is made in a serious vein, it is evidently intended to reflect somewhat the administrative resentment of the opposition by the American Medical Association to the trend of public and governmental thought.

In the meantime, however, the welfare and social workers have been constantly educating the public in the shortcomings of medicine; raising health questions and emotionally egging the laity on to demand a service that is beyond the present facilities of organized medicine. Also, in the meantime, the socialistic tendency of the present administration has led to a serious study of the socio-economic phases of public health and it has proceeded to formulate plans and programs for health security without approval by organized medicine, until at one time it seemed that plans for health security, which we are convinced is sure to come in the near future, would be devised, planned and executed without consideration of the organized representative medical body. Recently the American Medical Association has, in a measure, revised its plan of battle and is developing a more receptive attitude toward governmental reconstruction of health service.

We do not hold any brief for socialized health service as it has developed in other countries; nor do we in the least subscribe to the regimentation of medicine or dentistry, but we do believe that some form of socialized health service is inevitable, and we are still firm in the belief we have expressed many times since 1928, that a cooperative policy toward the general idea of social health security will be much more beneficial and constructive than one of blanket opposition on all counts.

Although dentistry has, for the most part, been inclined to follow the lead of medicine, we have in several instances adopted a more helpful and cooperative spirit toward the governmental activities. Ex-President Miner, during his administration, metaphorically extended the olive branch to the governmental representatives of social security and was assured that dentistry would be extended every courtesy and every privileged prerogative in any plan for dental health service to conform to the requirements of the social security program, and there the matter rests now, so far as dentistry is concerned.

The conference under discussion may be termed the most important of all the movements toward health security, as it went a step further than any other and stated the actual deficiencies in the present health services and ways and means of correcting them.

The deficiencies pointed out are:

(1) Preventive health services for the nation as a whole are grossly insufficient.

(2) Hospital and other institutional facilities are inadequate in many communities, especially in rural areas, and financial support for hospital care and for professional services in hospitals is both insufficient and precarious, especially for services to people who cannot pay the costs of the care they need.

(3) One-third of the population, including persons with or without income, is receiving inadequate or no medical service.

(4) An even larger fraction of the population suffers from economic burdens created by illness.

If these deficiencies actually exist, and it was practically admitted that they do by all but a very few of those attending the conference, the situation is serious and something needs to be done about it, and we believe that something will be done about it. We also believe that, if the organized medical profession will accord the proper cooperation in the matter, a program can be worked out that will be satisfactory and agreeable to all.

The plans suggested involve large sums of money for accomplishment of the ideals, and the governmental authorities show every willingness to make the necessary expenditures; so that, if we will, we can have a directive capacity in the new health service plans and determine their success or failure from the standpoint of our present conception of medical and dental health service.

L. P. A.

OBITUARY

FREDERIC R. HENSHAW, D.D.S., F.A.C.D.

(1872-1938)

Frederic Rich Henshaw, dean of the Indiana University School of Dentistry, died at his home in Indianapolis, Friday, May 27, in his sixty-sixth year.

Dr. Henshaw was born in Alexandria, Ind., October 8, 1872, the son of Seth B. and Mary Jane (Rich) Henshaw. He received his early education in the public schools of Alexandria and later in the Central Normal College of Danville, Ind. He attended the Indiana Dental College, from which he received the D.D.S. degree in 1897. After his graduation, he established himself in practice in Middletown. In 1909, he removed to Indianapolis, engaging in practice there until 1914, when he became dean of the Indiana Dental College, a position which he held until the time of his death.

Dr. Henshaw was for many years widely known in the dental profession for his intense interest in dental educational matters and for his active efforts in promoting dentistry through his position as dean of the School of Dentistry of the University of Indiana. He was a force in dentistry and his counsel and advice were constantly sought in dental educational circles. Although rather modest in stature, he was a man of commanding appearance and a most convincing speaker. A rare conversationalist, with a frank and sincere manner, he was an agreeable companion and loyal to the last degree to his numerous friendships.

Dr. Henshaw was a member of his local state association, which he served in the capacity of secretary and president; a member and president of the Indianapolis Dental Society; member and president of the American Association of Dental Schools; member of the American Dental Association; a Fellow of the American College of Dentists; member and vice-president of the National Association of Dental Examiners and a member and secretary for many years of the Indiana State Board of Dental Examiners. He was also a member of the Indiana State Council of Defense during the World War period. He also served as special examiner for the War Department and did active service as major in the Dental Corps. He was honorably discharged from the Corps in 1919 with the rank of lieutenant colonel.

He was at one time a member of the Indiana State Board of Health. He was a member of the Masonic Order, and of the Delta Sigma fraternity, of which he was Supreme Grand Master the year before his death.

Dr. Henshaw was married September 1, 1897, to Miss Mary Edith Strickler, of Middletown, Ind., who died about five years ago. The son born of this marriage died two years ago.

Dr. Henshaw's life-long interest in den-

tistry was devoted to elevating and maintaining the standards of dentistry and to the perfection of the dental school of which he was dean as a dental educational institution and in large part his efforts were highly successful. At a time when dental education was being revised upward almost continuously, his effort was to keep the Indiana school at the head of the procession and in this he was signally successful. One of his outstanding achievements, as the result of his tireless labor for the Indiana University Dental School, was the designation of the dental school as a center for research in children's dentistry by the United States Public Health Service. The school and the children's clinic stand as a monument to him and, as he once stated, "a dream come true."

FREDERIC RICH HENSHAW
(1872-1938)

Truly a noble standard-bearer for dentistry has passed on, and his many friends and those who knew him as students and after graduation will miss him greatly.

COUNCIL ON DENTAL THERAPEUTICS

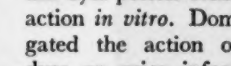
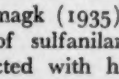
The following article is presented as one in the Council's series on pharmacology and therapeutics. On behalf of the profession, the Council expresses appreciation to the authors for their contribution.

SULFANILAMIDE: A REVIEW OF THE CLINICAL AND EXPERIMENTAL WORK ON ITS THERAPEUTIC PROPERTIES*

By FRANK F. KANTHAK, M.D., and PAUL P. PICKERING, D.D.S., Chicago, Ill.

NO drug has been placed before the medical profession in years which has attracted so much attention as sulfanilamide. The apparent efficiency of this drug in certain types of infection has led to its rapid adoption and experimental use in a great variety of conditions, although as yet little is known of its toxic properties and therapeutic limitations. It is the purpose of this report to summarize the available clinical and experimental data on the therapeutic use of sulfanilamide.

PHARMACOLOGY

Eisenberg noted in 1913 that certain azo dyes possess considerable bactericidal action *in vitro*. Domagk (1935) investigated the action of sulfanilamide-azo dyes on mice infected with hemolytic streptococci and, in 1936, after investigation of the bactericidal action of the azo dyes, reported that prontosil $HCl.NH_2$  was one of the most active. Many related groups have since been studied with the indication that sulfanilamide, para-aminobenzene sulfonamide (prontylin, sulfamidyl, etc.), is the pharmacologically effective portion of the prontosil molecule. (Tréfouel, 1935; Buttle, 1936.) It appears evident from further work that sulfanilamide, H_2N  , is formed from the reduction of prontosil *in vivo* (Bliss and Long, 1937), and Fuller (1937) has isolated sulfanilamide from the urine of patients receiving prontosil. Recently, Marshall and his associates have described a simple biochemical method for the quantitative determination of sulfanilamide in body fluids. They have noted, after a single oral dose in human beings, that the drug is absorbed in about four hours and that a maximum concentration is reached in the blood stream within from four to six hours. They demonstrated that this drug is almost wholly excreted in the urine and that this is rapidly accomplished by the normal kidney. In patients with decreased renal function, Marshall found a diminished ability to excrete sulfanilamide and noted that the continued ingestion of the drug in these cases resulted in an accumulation of this chemical in the body. It was also noted that the drug rapidly passed over into all body fluids,

*From the Walter G. Zoller Memorial Dental Clinic, University of Chicago.

including saliva, in approximately the same concentration as was found in the blood. These observations have been of great importance in establishing a rational basis for therapy in human beings.

The mode of action of sulfanilamide is still not clear. In the original experiments of Domagk, a virulent strain of hemolytic streptococcus derived from a human subject was employed. Control mice, when injected with 0.3 cc. of a diluted culture, usually died within twenty-four hours. When the infected animals were injected with from one-tenth to one-fiftieth of the tolerated dose of prontosil, curative effects were noted, and if the injections were continued for from three to five days, the majority of the animals recovered. It has been shown by Colebrook, Buttle and O'Meara (1936) that sulfanilamide is active *in vitro* as well as *in vivo*. Human defibrinated blood infected with streptococci to which sulfanilamide 1:13,000 and 1:18,000 had been added was free from streptococci in two days; whereas, in control blood, a distinct increase in the number of organisms occurred in from ten to twenty-four hours. Marshall has shown that concentrations of sulfanilamide between 1:5,000 and 1:10,000 can be attained and maintained in human blood *in vivo*.

Certain observers have reported a definite bactericidal influence on beta hemolytic streptococci *in vivo* and against the pneumococcus *in vitro*. Bliss and Long (1937) reported that sulfanilamide inhibited the growth of susceptible organisms *in vitro* and that *in vivo* it brought about a change in the micro-organisms which permitted them to be phagocytized by the white blood cells. They believe that bacteriostasis plays an important rôle in the control of experimental streptococcic infection and in a reduction in the rate of cell division of the organism permitting the bactericidal properties of human serum to take place and phagocytosis to destroy organisms. On the basis of bone marrow culture studies, they conclude that the effective concentration of sulfanilamide against hemolytic streptococci in serum would seem to be about 1:100,000 or about one-tenth the concentration usually maintained clinically. However, this finding must be supported by adequately conducted clinical studies before it can be accepted. As a result of a clinical investigation, Bigler, Clifton and Werner (1938) concluded that the action of sulfanilamide seems to be independent of the leukocytes, in that it does not produce an increase in the total leukocytes or in the proportion of the polymorphonuclear cells. As a matter of fact, in this series of cases, sulfanilamide seemed to cause a depression of the white blood cells, even to a point at which a leukopenia occurred. In view of the obscure mode of action of this drug, it is not possible at the present time to comment specifically on this phase. However, it seems likely that sulfanilamide acts primarily as a detoxifying agent, permitting the normal defense mechanisms to act on the infecting organisms.

THERAPEUTIC EFFECTS

The clinical evaluation of sulfanilamide tends to confirm the favorable laboratory impressions created by this drug. The early clinical reports closely following publication of Domagk's work in 1935 dealt with the use of prontosil and prontosil solution in the treatment of streptococcal thrombophlebitis, adenitis, otitis media, erysipelas, puerperal fever and arthritis. In general, the therapeutic results were good. However, there was a difference of opinion as to the efficacy of these chemicals in the treatment of staphylococcal infections. Following these reports are numerous communications dealing with the use of sulfanilamide and its derivatives in a number of widely divergent conditions. Long and Bliss

(1937) chose to evaluate the effectiveness of sulfanilamide by its use in hemolytic streptococcal meningitis, a disease which in the past has been recognized as almost invariably fatal. In an analysis of twenty-eight cases of streptococcal meningitis treated with sulfanilamide, twenty-four patients, or 85 per cent, recovered. This recovery ratio is to be contrasted with a case fatality of 99 per cent before the use of sulfanilamide in the treatment of hemolytic streptococcal meningitis, and it constitutes what the authors term irrefutable evidence of the value of sulfanilamide therapy in the treatment of severe beta hemolytic streptococcal meningitis. Schwentker, Gelman and Long (1937) and Willien (1938) report the successful treatment of meningococcal meningitis with sulfanilamide, thereby reducing the necessity of intraspinal and intravenous serum therapy.

The use of sulfanilamide in the treatment of gonococcic infections was first reported by Dees and Colston (1937) and their favorable results in nineteen cases have been verified by others. This observation resulted in the wider use of sulfanilamide as an urinary antiseptic in acute and chronic phases of infection of the urinary tract. Its use here eliminates many of the objections common to other drugs in that it is quickly effective in alkaline urine and in addition it may be administered in the acute phases of infection; whereas certain other agents, notably mandelic acid and the ketogenic diet, cannot. Because of its lack of action against certain urinary organisms, notably *Streptococcus fecalis,* it cannot entirely replace other agents. In addition, for unknown reasons, certain theoretically susceptible infections which have proved resistant to treatment with sulfanilamide do respond to the earlier urinary drugs.

Sulfanilamide has not received very extensive use in the treatment of dental or oral infections. Raper and Manser (1937) report its successful use in one case of postextraction infection associated with *Streptococcus viridans* and *Staphylococcus aureus.* These authors suggest that sulfanilamide be tried in pyorrhea, Vincent's infection, streptococcal stomatitis and allied diseases to determine whether it will be effective. Sinclair and Barker (1938) have used sulfanilamide locally in the treatment of dry sockets, infected extraction wounds and fractures of the jaws. A portion of a 5-grain tablet of sulfanilamide was placed in the wound, with prompt healing of the lesion in the cases reported and cessation of the usual pains. As no cultures of the wounds treated were made, the bacterial flora are not known. These observations are, therefore, difficult to evaluate in the absence of more detailed and accurate case histories. Caro (1938) reports the use of sulfanilamide with favorable results in two cases of pemphigus, one of which presented oral lesions. Large denuded areas showed signs of epithelization and no new areas appeared during the period of observation. In one case of oral pemphigus under our care in which sulfanilamide, 35 grains daily, was administered for a period of three weeks, no objective improvement was noted, though the patient thought he was somewhat better. One case of streptococcal stomatitis of several years' duration from which beta hemolytic streptococci were cultured, was treated with sulfanilamide 60 grains daily. Medication was discontinued at the end of four days because of cyanosis, headache and photophobia. No improvement was noted in the oral lesions.

In addition to the foregoing diseases, reports of the successful use of sulfanilamide have appeared in the treatment of the following diseases, from which beta hemolytic streptococci were isolated: mastoiditis, otitis media, sinusitis, peritonitis, brain abscess, erysipelas and scarlet fever. Whether the use of this drug in these conditions is sufficiently impressive to eliminate previous forms of treatment remains to be determined. In most

instances, it has been supplementary to the usual therapy, with generally favorable results.

Only recently have reports of failures in sulfanilamide therapy begun to appear in the literature. It is to be expected that the limitations and usefulness of this drug will be more completely evaluated with the passage of time.

TOXIC MANIFESTATIONS

It was early recognized that sulfanilamide and its derivatives might prove toxic, as certain other benzene ring compounds have. The most serious manifestations of toxicity associated with sulfanilamide therapy are those concerning the blood or hematopoietic system. A number of cases of acute hemolytic anemia, characterized by a sudden fall in the hemoglobin and the red cell count, by macrocytosis and poikilocytosis, and the appearance of nucleated red blood cells and large numbers of reticulocytes in the peripheral blood, have been reported. Associated with these findings was the development of jaundice and usually a marked urobilinuria. In several of the patients reported, the anemia developed was so severe as to require one or more transfusions for its treatment. The mechanism of the production of the anemia is not known. It may represent an idiosyncrasy of the patient to the drug, or it may indicate an abnormal susceptibility of the red blood cells to be hemolyzed by sulfanilamide. Cyanosis, methemoglobinemia and sulfhemoglobinemia following the administration of this drug have been reported. Bucy (1937) reports the occurrence of toxic optic neuritis after the administration of a single tablet (0.3 gm.) of sulfanilamide following two previous episodes of headache, cyanosis and diarrhea associated with the use of this drug. In each instance, the symptoms rapidly subsided after withdrawal of the drug. He emphasizes the importance of not administering sulfanilamide and any sulfate simultaneously. This is in accord with the observations of Colebrook and Kenny (1936) and Paton and Eaton (1937), who note that sulfanilamide and related drugs give rise to toxic symptoms when given simultaneously with magnesium sulfate or other sulfates. Several cases of fatal granulocytopenia (agranulocytosis) have been reported as following sulfanilamide therapy. The mechanism of this effect is not clear. The work of Bigler, Clifton and Werner (1938) indicates that one of the actions of sulfanilamide is to cause a depression of leukocytes. Two instances of leukopenia developed in their series, but granulocytopenia did not occur among their thirty-three patients. Marshall, Cutting and Emerson (1938), working with dogs and rabbits, reported that repeated large doses of sulfanilamide produced no consistent effect on the red, white or differential count. Osgood's experiments seem to indicate that sulfanilamide has no direct toxic action on the nucleated cells of the blood and bone marrow studied. However, such observations do not exclude the occasional idiosyncrasy of a patient to this drug, which would explain the development of occasional cases of granulocytopenia. In the recent investigation of deaths following administration of "Elixir of Sulfanilamide-Massengill," it seems evident, from laboratory and clinical reports, that the toxic effect in this series is due to the use of diethylene glycol as a vehicle in the elixir. Large doses of sulfanilamide alone produced no lesions of the kidneys or liver in a series of laboratory tests on rabbits and dogs. Milder toxic manifestations reported from the use of sulfanilamide include dermatitis, a specific febrile reaction, mental confusion and acidosis. The acidosis developed is largely concerned with the loss of sodium and potassium in the urine and a fall in the carbon dioxide combining power of the blood plasma. This may be prophylactically treated routinely by the administration of sodium bicarbonate with each dose of sulfanilamide. Long and Bliss (1937) re-

port that in patients suffering from acute toxic manifestations of sulfanilamide therapy, large amounts of fluid by mouth act as an antidote by providing more rapid elimination through the kidneys. They make use of this observation in treating unpleasant reactions.

It is evident from the foregoing discussion that sulfanilamide is far from being non-toxic. In a series of 114 cases of beta hemolytic streptococcic infection treated by Hageman and Blake (1938), fifty-six, or 49.1 per cent, presented various toxic manifestations. These authors sensibly conclude that when a therapeutic agent causes an illness which may occasionally be more severe than the initial infection, one is forced to consider the possible toxic effects seriously before advocating its widespread use, at least for the milder forms of streptococcic infection. Certainly the indiscriminate use of the drug for infections of the mouth or elsewhere in the absence of bacteriologic or clinical indications is to be condemned.

METHODS OF ADMINISTRATION OF SULFANILAMIDE OR ITS DERIVATIVES

In view of recent work on the pharmacology of these compounds, it is evident that administration of sulfanilamide by mouth is the method of choice. However, if patients cannot swallow tablets or oral administration is not desirable for other reasons, "prontosil solution" or a 1 per cent solution of sulfanilamide in sterile physiologic sodium chloride solution may be administered subcutaneously. In serious illnesses such as hemolytic streptococcal meningitis, peritonitis and septicemia, an attempt is made to control the infection as soon as possible by the administration of a large initial dose of sulfanilamide, the aim being to attain a blood level of about 10 mg. per cent within four hours. To do this, Long and Bliss administer an initial dose of from ten to sixteen 5-grain tablets to adults, following this with three 5-grain tablets every four hours, to maintain the sulfanilamide level in the blood. In children, the dose is proportionately reduced. Sulfanilamide solutions may be given by the intrathecal route in the treatment of streptococcal or meningococcal meningitis without evidence of irritation to the meninges. "Prontosil solution" is definitely irritating when given intrathecally and should not be used this way, but is best given by the subcutaneous route. After definitely favorable clinical results have been obtained, the dose of sulfanilamide should be rapidly decreased. It is important not to withdraw the drug entirely until the patient is well on the road to recovery as relapses are frequent. In subacute and chronic infections, the recent tendency is to reduce the dose of sulfanilamide considerably. Doses from 20 to 50 grains a day may be used with effect. As soon as definite clinical improvement is noted, the dosage should be reduced, or if no therapeutic effect is noted, the dosage may be increased. It is important to emphasize again that frequent red, white and differential blood counts are necessary for control of the quantity of the drug when administered to patients over a number of days.

SUMMARY

Sulfanilamide (para-aminobenzene sulfonamide) and its derivatives are powerful chemotherapeutic agents in the treatment of certain infections, notably those associated with the beta hemolytic streptococcus. The pharmacology and mechanism of its action are imperfectly understood. Sulfanilamide has certain toxic effects, particularly on the hematopoietic system, the most serious of which is the occasional development of fatal granulocytopenia. This necessitates careful periodic examination of the blood in order to avoid overdosage. Oral administration is the method of choice. The dose should be reduced when clinical improvement is evident. Its use in dental infections or acute and chronic infections of the face and jaws has been so limited that no con-

clusions regarding its effectiveness are here warranted.

BIBLIOGRAPHY

Berg, S., and Holtzman, M.: Fatal Granulocytopenia from Sulfanilamide. *J.A.M.A.*, 110:370, January 29, 1938.

Bigler, J. A.; Clifton, W. M., and Werner, Marie: Leukocyte Response to Sulfanilamide Therapy. *J.A.M.A.*, 110:343, January 29, 1938.

Bliss, Eleanor, and Long, P. H.: Activation of "Prontosil Solution" in Vitro by Reduction with Cysteine Hydrochloride. *Bull. Johns Hopkins Hosp.*, 60:149, February 1937.

Borst, J. G. G.: Death from Agranulocytosis After Treatment with Prontosil Flavum. *Lancet*, 1:1519, June 26, 1937.

Bucy, P. C.: Toxic Optic Neuritis Resulting from Sulfanilamide. *J.A.M.A.*, 109:1007, September 25, 1937.

Caro, M. R.: Pemphigus: Treatment with Sulfanilamide: Preliminary Report. *Arch. Derm. & Syph.*, 37:196, February 1938.

Colebrook, L., and Kenny, M.: Treatment with Prontosil of Puerperal Infections Due to Hemolytic Streptococci. *Lancet*, 2:1319, December 5, 1936.

Colebrook, L.; Buttle, G. A. H., and O'Meara, R. A. Q.: The Mode of Action of p-Aminobenzenesulfonamide and Prontosil in Hemolytic Streptococcal Infections. *Lancet*, 2:1323, December 5, 1936.

Dees, J. E., and Colston, J. A. C.: Use of Sulfanilamide in Gonococcic Infections. *J.A.M.A.*, 108:1855, May 29, 1937.

Discombe, G.: Sulfhemoglobinemia Following Sulfanilamide Treatment. *Lancet*, 1:626, March 13, 1937.

Domagk, G.: Ein Beitrag zur Chemotherapie der bakteriellen Infektionen. *Deutsche Med. Wchnschr.*, 61:250, February 15, 1935.

Elixir of Sulfanilamide-Massengill. (Special article from American Medical Association Chemical Laboratory). *J.A.M.A.*, 109:1530, November 6, 1937.

Frost, L. D. B.: Sulphaemoglobinaemia Following Antistreptococcal Chemotherapy. *Lancet*, 1:510, February 27, 1937.

Fuller, A. T.: Is p-Aminobenzenesulfonamide the Active Agent in Prontosil Therapy? *Lancet*, 1:194, January 23, 1937.

Hageman, P. O., and Blake, F. G.: Clinical Experience with Sulfanilamide in Treatment of Beta-Hemolytic Streptococci Infections. *Am. J. M. Sc.*, 195:163, February 1938.

Harvey, A. M., and Janeway, C. A.: Development of Acute Hemolytic Anemia During Administration of Sulfanilamide. *J.A.M.A.*, 109:12, July 3, 1937.

Helmholtz, H. F.: Comparison of Mandelic Acid and Sulfanilamide as Urinary Antiseptics. *J.A.M.A.*, 109:1039, September 25, 1937.

Kohn, S. E.: Acute Hemolytic Anemia During Treatment with Sulfanilamide. *J.A.M.A.*, 109:1005, September 25, 1937.

Long, P. H., and Bliss, Eleanor: Para-Aminobenzene Sulfonamide and Its Derivatives: Experimental and Clinical Observations on Their Use in Treatment of Beta-Hemolytic Streptococcus Infections: Preliminary Report. *J.A.M.A.*, 108:32, January 2, 1937. The Clinical Use of Sulfanilamide and Its Derivatives in the Treatment of Infectious Diseases. *Ann. Int. Med.*, 11:575, October 1937.

Marshall, E. K., Jr.: Determination of Sulfanilamide in Blood and Urine. *Proc. Soc. Exper. Biol. & Med.*, 36:422, April 1937.

Marshall, E. K., Jr.; Emerson, K., and Cutting, W. C.: Para-Aminobenzenesulfonamide. *J.A.M.A.*, 109:953, March 20, 1937.

Marshall, E. K., Jr.; Cutting, W. C., and Emerson, K., Jr.: Toxicity of Sulfanilamide. *J.A.M.A.*, 110:252, January 22, 1938.

Newman, B. A., and Sharlit, H.: Sulfanilamide: Photo-Sensitizing Agent of Skin. *J.A.M.A.*, 109:1035, September 25, 1937.

Osgood, E. E., and Brownlee, I. E.: Culture of Human Marrow. Studies on Mode of Action of Sulfanilamide. *J.A.M.A.*, 110:349, January 29, 1938.

Paton, J. P. J., and Eaton, J. C.: Sulphaemoglobinemia and Methemoglobinemia Following Administration of p-Aminobenzenesulfonamide. *Lancet*, 1:1159, May 15, 1937.

Raper, H. R., and Manser, J. G.: Use of Sulfanilamide in Postoperative Acute Cellulitis. *D. Digest*, 43:434, September 1937.

Schonberg, I. L.: Purpuric and Scarlatiniform Eruption Following Sulfanilamide. *J.A.M.A.*, 109:1035, September 25, 1937.

Schwartz, W. F.; Garvin, C. F., and Koletsky, S.: Fatal Granulocytopenia from Sulfanilamide. *J.A.M.A.*, 110:368, January 29, 1938.

Schwentker, F. F.; Gelman, S., and Long, P. H.: Treatment of Meningococcic Meningitis with Sulfanilamide. *J.A.M.A.*, 108:1407, April 24, 1937.

Sinclair, J. A., and Barker, O. C.: Preliminary Report on Local Use of Sulfanilamide in Treatment of Oral Lesions. *Am. J. Orthodontia*, 24:266, March 1938.

Tréfouel, J., et al.: Activité de p-amino-

phénylsulfamide sur les infections streptococciques expérimentales de la souris et du lapin. *Compt. rend. Soc. de Biol.*, 120:756, 1935.

WELCH, A. D.: Pharmacologic Basis for Sulfanilamide Therapy. *J. Pediat.*, 11:159, August 1937.

WILLIEN, L. J.: Sulfanilamide Therapy in Meningococcic Meningitis. *J.A.M.A.*, 110:630, February 26, 1938.

YOUNG, C. J.: Agranulocytosis and Para-Aminobenzene Sulphonamide. *Brit. M. J.*, 2: 105, July 17, 1937.

ACCEPTED DENTAL REMEDIES

The Council on Dental Therapeutics of the American Dental Association announces the inclusion of the following articles in the list of Accepted Dental Remedies.

Anesthetics—Local*

Minimax Procaine Solution 2% with Epinephrine 1:70,000: Each cubic centimeter contains procaine hydrochloride, U.S.P., 0.02 gm.; epinephrine, 0.000014 gm.; disodium phosphate, 0.003 gm.; sodium bisulfite, 0.0015 gm., and sodium chloride, 0.00265 gm., and distilled water.

Manufactured by Minimax Co., Chicago, Ill. No U. S. patent or trademark.

Minimax Procaine Solution 2% with Epinephrine 1:70,000 in Cartridges.

Calcium Compounds**

Peerless Precipitated Calcium Carbonate Extra Heavy Grade 16, Medium Heavy Grade 24, Medium Light Grade 40, Extra Light Featherwate Grade 60: Peerless Precipitated Calcium Carbonate complies with U.S.P. XI (p. 96). It is used in the manufacture of dentifrices.

Manufactured by Peerless White Lime Co., Ste. Genevieve, Mo.

CHEMICAL ANALYSIS: 98.8 to 99.4 per cent calcium carbonate.

PHYSICAL PROPERTIES:

PARTICLE SIZE: The particle size distribution determined according to the method of Perrot and Kinney (See A.D.R. 1938, p. 96) is claimed to have the following typical distribution:

	Diameter in Microns			
Grade No.	1 to 5	5 to 10	10 to 20	20 to 30
16	61%	30%	8%	1%
24	75%	21%	4%	
40	61%	28%	9%	2%
60	86%	11%	3%	

DENSITY IN TERMS OF SETTLING VOLUME: Obtained by shaking a mixture of 10 gm. carbonate diluted to 250 with water.

Grade No.	Cc's Final Settling Volume
16	16 to 18
24	23 to 25
40	39 to 43
60	57 to 63

ABRASIVENESS: The abrasiveness of Peerless Precipitated Calcium Carbonate is determined by rotating a polished surface of antimony and/or silver in a slurry of chalk and water under a weight of 63 gm. for 6,000 revolutions on a test machine. (Details filed with the Council.) The area of the metal specimens exposed was 54 square millimeters and the Bierbaum hardness was 231 units antimony and 200 units for silver.

	Average Mg. Loss	
Grade No.	Antimony	Silver
16	2.8	5.2
24	3.4	4.8
40	3.8	4.7
60	3.8	4.5

*A.D.R. 1938, p. 36.

**A.D.R. 1938, p. 89.

Dentifrices†

Gimbel's Tooth Paste.—Composition: See Sheffield Tooth Paste (A.D.R. 1938, p. 117).

Manufactured by The Sheffield Company, New London, Conn. Distributed by Gimbel Brothers, New York City. No U. S. patent or trademark.

Field Tooth Paste.—Composition: See Sheffield Tooth Paste (A.D.R. 1938, p. 117).

Manufactured by The Sheffield Company, New London, Conn. Distributed by Beck Drug Co., Inc., New York City.

Filene's Own Tooth Paste.—Composition: See Sheffield Dental Cream (A.D.R. 1938, page 117).

Manufactured by the Sheffield Company, New London, Conn. Distributed by Wm. Filene's Sons Company, Boston, Mass. No U. S. patent or trademark.

Angert's Tooth Paste.—Composition: See Sheffield Tooth Paste (A.D.R. 1938, page 117).

Manufactured by the Sheffield Co., New London, Conn. Distributed by Angert's Drugs, Brooklyn, N. Y. No U. S. patent or trademark.

Y & S Tooth Paste.—Composition: See Sheffield Tooth Paste (A.D.R. 1938, page 117).

Manufactured by the Sheffield Co., New London, Conn. Distributed by Young & Spielman, Bronx, N. Y. No U. S. patent or trademark.

Admission of an article to the list of Accepted Dental Remedies does not imply a recommendation. Information on the rules and work of the Council will be sent on request.

HAROLD L. HANSEN, *Secretary.*

†A.D.R. 1938, p. 112.

The St. Louis Auditorium.

ASSOCIATION ACTIVITIES

LEGISLATIVE COMMITTEE

THE Committee on Legislation presents the following brief survey of recent dental legislation and court action in the various states.

ALABAMA

The state legislature meets once every four years and did not meet in 1938. There was no special session and no court action within the state.

ARIZONA

This is a legislative year. An amendment may be proposed next year and opposition is expected from the state newspaper association and outdoor advertising concerns.

In a recent declaratory judgment, the state supreme court stated that the Arizona Dental Practice Act clearly authorizes a dentist to administer a complete anesthetic, recognizing that it has become a necessary adjunct to his everyday practice and that graduating dentists are trained in this procedure.

ARKANSAS

No report. No legislative session.

CALIFORNIA

There is no legislative activity and none is pending. There are several cases in the process of litigation which involve appeals from the actions of the board to suspend licenses for infractions of the Dental Practice Act.

A recent decision overruled a long line of cases which had held that the board was a quasijudicial body and therefore writs which applied to courts of the state could be used before this body. This later decision held that the dental board was solely an administrative body under the executive branch of the government and a writ of mandamus is the proper action to take in demanding relief. This is consistent with the holdings in the majority of the other states.

COLORADO

No report. No legislative session.

CONNECTICUT

The state dental act was amended in 1937 in the following sections:

A. With reference to practice of dentistry by corporations. This section was made more inclusive by prohibiting any person, except a licensed and registered dentist, as well as any corporation, from owning or operating a dental office.

B. Advertising for patronage by means of handbills, posters, circulars, stereopticon slides, motion pictures, radio or newspapers; advertising any free dental work or free examination, or advertising to guarantee any dental service, or to perform any dental operation painlessly was made new grounds for revocation of a license.

C. A person is prohibited from operating more than one office without the approval or consent of the dental commission. The prior section permitted the operation of two offices without obtaining the consent of the commission.

DELAWARE

The legislature is not in regular session. Certain changes in the dental law are contemplated if conditions are favorable at the next session of the legislature.

DISTRICT OF COLUMBIA

The most important problem faced this year was an attempt at revision of the

statutes governing the practice of dentistry made necessary by a judicial decision holding that the present law did not forbid the repairing of dentures by laboratories without the written prescription of a dentist.

A new law was drafted and introduced in Congress by Senator King of Utah and Congressman Cochran of Missouri, but was not acted on by that body because of lack of time in the closing days of the last session, although the House District Committee did hold a hearing on the bill.

As the people of the district have no voice in their government, and are deprived of the right to vote, it will be necessary that the American Dental Association and the state associations aid in the fight. The revision of the law was bitterly opposed by the advertising dentists.

FLORIDA

Several cases have been prosecuted in the past six months for illegal practice of dentistry, but the validity of the law has not been contested.

Attempts are being made to have the Federal Trade Commission act to restrain Hod Williams, of Tampa, from conducting his mail order denture business.

The committee hopes to have the law amended so that dentists who have been convicted of illegal practice will be barred from continuing to practice until there is further legal action by the violator.

GEORGIA

The dental practice act was revised this year to protect the public from unclean dentists or unscrupulous dentists who use guarantees, advertisements and other inducements. Every member of the legislature was made aware of the value of the amendments and it was passed unanimously.

There was only one case of violation of the act in which action was delayed. The violator was a woman who ran a dental laboratory and practiced dentistry as well. The superior court finally issued an injunction preventing her from going to her office and the case appears to be closed.

IDAHO

No legislative activity or prosecutions.

ILLINOIS

In the regular session of the state legislature, a bill regulating the practice of oral hygiene, but not sponsored by the dental society, was killed in a general tabling. In the special session, a bill to extend the provisions of the sales tax to include dental laboratories and perhaps dentists was also defeated.

The license of Dr. A. A. Dubin was revoked by the Department of Registration and, October 22, 1937, the state supreme court sustained the conviction of Dr. Dubin for violation of the Dental Practice Act.

The license of Dr. W. E. Kaplan was revoked for a six month period for aiding one William J. Prindiville, operating a dental laboratory, to take impressions and make dentures. Prindiville was fined $200.

The decision of the U. S. District Court in the District of Columbia granting to Dr. S. B. Heininger an injunction against a fraud order issued by the Post Office Department was printed in the August 1938 JOURNAL.

June 22, 1938, Judge Donald S. McKinlay of the Superior Court of Cook County ordered the Department of Registration to restore the license of Dr. Heininger on the ground that the revocation had been granted on insufficient evidence.

Both of the above-mentioned decisions have been appealed to higher tribunals and the cases are still pending. No further action can be taken until decisions have been rendered. Further develop-

ments in respect to these cases regarding Dr. Heininger will be reported as they occur.

Some revision of the act will be proposed by the legislative committee at the next session of the legislature, but the action has not yet been determined.

INDIANA

The 1935 law is functioning quite satisfactorily. One case (State Board of Dental Examiners vs. Boston System Dentists) is pending before the state supreme court. The board is attempting to oust this corporation via a permanent injunction.

IOWA

No legislative activity. Only one case has come up in the courts all year.

KANSAS

The State Dental Board revoked the licenses of two advertising dentists in Kansas City, Kan. The complainants were all officers of local dental societies. The attorneys for the two defending dentists immediately filed injunction suits in the County District Court against enforcement of the order.

KENTUCKY

The Kentucky dental law was amended and the amendments went into effect May 29, 1938. All public announcements are abolished except the use of professional cards. The state board of dental examiners formerly was limited to recognition of the Dental Educational Council's rating of dental schools. Now they may decide what group or classification will be recognized. The clause making reciprocity optional has been removed and no provision made for reciprocity. These are the outstanding amendments to the act.

The dental board now has the services of an assistant attorney general, who is assigned to the division of professional regulation. Law enforcement has definitely progressed since this attorney was appointed.

Most of the proceedings under the act have been prosecutions of laymen for practicing dentistry. In one case, a child died of acute osteomyelitis following an extraction with ordinary pliers. The offender was fined $100.

LOUISIANA

No report. Legislature in session.

MAINE

Two years ago, the dental practice act was thoroughly revised. Next January, the society plans to work for a few minor changes to complete the effectiveness of the bill. No great difficulty is expected in having the Amendments passed.

MARYLAND

An improved dental practice act was passed in the spring of 1937. Before it became a law, persons opposed to it obtained the 10,000 signatures necessary to submit the bill to a public vote. This vote will not be taken until November and, in the meantime, the Committee on Legislation investigated some of the 10,000 signatures and found enough false ones to reduce the number to less than 10,000.

With this evidence in hand, the committee obtained an injunction to prevent the supervisor of elections from placing the referendum on the ballot. The injunction was contested and, at the present time, the case is pending in the court of appeals and should come up in September.

MASSACHUSETTS

In 1937, an act was passed greatly restricting advertising in any manner other than by the professional card or a sign at the place of business. At the present time, there is a test case pending before the state supreme court. It will be argued in October. The defendant, a Dr. Fred P. Brown, was found guilty and fined one dollar by the superior court and he immediately appealed, alleging that the statute violates both the Massachusetts and the United States constitu-

tions because it is arbitrary and unreasonable and it deprived him of his property without due process of law.

Should the law be upheld, the state society plans an active campaign to compel full compliance with the law.

MICHIGAN

During the past year, there has been considerable activity in the prosecution of cases of law violation, especially those concerning illegal practice of dentistry by laboratory technicians.

MINNESOTA

There was no legislative activity. The state board has been active in prosecuting illegal practitioners. The Supreme Court of Minnesota upheld the provisions of the law as applied to advertising, when they were attacked as unconstitutional (Gullings vs. State Board of Dental Examiners. 273 N.W. 703). Several other men were fined for practicing without a license.

MISSISSIPPI

No report. Legislature in session.

MISSOURI

A new dental law was passed about a year ago and since then the dental board has filed charges against fourteen advertising dentists. All the dentists obtained restraining orders against the board, but these were eventually dismissed. The board then proceeded against seven of the men, revoking the licenses of two. The remainder of the cases are pending. The men whose licenses were revoked have appealed and their case is pending in the circuit court.

Of the five advertising dentists in Kansas City, four have closed their offices and the fifth is under grand jury indictment.

MONTANA

No legislative or court action.

NEBRASKA

No report. No legislative session.

NEVADA

No report. No legislative session.

NEW HAMPSHIRE

No court or legislative activity in the past six months.

NEW JERSEY

No report. Legislature in session.

NEW MEXICO

The recent amendments to the law were taken from the Indiana Dental Law. The paragraphs or sections relating to illegal practice, unprofessional conduct, advertising and the injunction were added to our law at the last session of the legislature.

All of the advertising dentists have been eliminated by use of the injunction. The new law has been very effective.

NEW YORK

The legislature passed a bill introduced by Assemblyman Robert F. Wagner, Jr., creating a commission to study ways and means of providing a practical long range health program. The legislature believes that adequate medical care is an essential element of public health, and that present methods should be supplemented by state and local governments.

The state society legislative committee actively participated in the consideration of seventeen bills either indirectly or directly involving the dental profession.

NORTH CAROLINA

No report. Legislature not in session.

NORTH DAKOTA

No report. No legislative session.

OHIO

No legislation is pending and no court action except minor cases of illegal practice.

OKLAHOMA

The outstanding and unique provisions of the Oklahoma law were discussed in the August 1938 issue of THE JOURNAL. As it is a very different type of act, it cannot be discussed in a brief report. There was no report made concerning violations of the law.

OREGON

No legislation. The Dental Practice Act is being attacked as unconstitutional because it does not provide for an appeal to a court from a suspension order. The question has been raised by one Harry Semler, whose license was suspended for violation of the advertising regulations.

PENNSYLVANIA

In January 1938, representatives of the state dental society met with members of the state law enforcement department in an attempt to clarify interpretations of the dental law. Copies of the interpretations agreed on were sent to all known advertising dentists in order to permit rectification of advertising before a thorough program of prosecution was begun.

RHODE ISLAND

No report.

SOUTH CAROLINA

No report. Legislature in session.

SOUTH DAKOTA

The 1937 law is very satisfactory.

There are no prosecutions and no immediate changes in the law are contemplated.

TENNESSEE

The legislature is not in session. No action has been taken against former advertisers since the law was amended to prohibit advertising, in 1935. There are usually several bills introduced in legislative years which seek to permit licensure of unqualified persons and these are always watched.

TEXAS

The constitutionality of the law as amended in 1937 was upheld by the Court of Appeals. It is now pending in the Supreme Court of Texas. The case has been carried up by the advertising dentists and the Newspaper Publishers Association of Texas. The same parties have threatened to try to amend the law and the dentists are ready to fight to maintain it.

A special committee of the state society recommended that no action be taken on the question of licensing dental hygienists at the next session of the legislature.

UTAH

There has been no legislative or court activity in the past six months. There is some concern among members about the existence of cooperatives in the state, but no action has been taken.

VERMONT

No report. Legislature not in regular session.

VIRGINIA

The dental practice act of 1936, contested by the leading advertising dentist of the state, has been upheld by the Supreme Court of Virginia and was reported in the April issue of THE JOURNAL (Goe vs. Gifford *et al.*).

WEST VIRGINIA

No report. Legislature not in regular session.

WISCONSIN

There is no legislative session. There are indications that the Biemiller Bills will be introduced next session. Workers who favor the bills have been endeavoring to create favorable sentiment among farm and labor voters.

WYOMING

No legislative or court activity.

RESEARCH COMMISSION

SOME PROPERTIES OF TWO TYPES OF RESINS USED FOR DENTURES*

By IRL C. SCHOONOVER,† Ph.D., and W. T. SWEENEY,‡ A.B., Washington, D. C.

I INTRODUCTION

IN recent years, the interest in synthetic resins for dentures has been such that almost all of the resins produced have at some time received the attention of both manufacturers of dental materials and of dentists. These resins as a group have many desirable properties, but it must be realized that, at the present time, no single resin possesses all the properties which are considered desirable for dentures.

It is not the purpose of this paper to present a detailed series of experiments from which one ideal denture resin may be chosen. Rather, it is more important at this time to call attention to the individual limitations of typical resins and to point out certain factors which may account for some of the difficulties which have been encountered by the dental profession. For example, explanations have been sought as to why one operator can successfully mold a thermoplastic resin one time and will fail with the same resin at another; why dentures made from a thermosetting resin sometimes have bubbles and at other times have not; why dentures made from the same resin have different colors. The explanations of these and other difficulties have been sought and are presented at this stage of the research to aid those who are attempting the use of these materials, which has so many peculiar results.

Resins may be conveniently classified as thermoplastic or thermosetting on the basis of the effect of heat on the material as it is shaped to its final form. For clarity, the results obtained on these two types of resins will be considered separately.

II THERMOPLASTIC RESINS

The thermoplastic resins may be repeatedly softened by heating and hardened by cooling without undergoing a chemical change. They may be considered as being composed of bundles of chainlike molecules (called polymers) of many different lengths and molecular weights. To some extent, the properties of this type of material depend on the polymer distribution; that is, the relative amounts of the chains of various lengths present in the resin. It is possible, for example, to produce from the same material a number of resinous products having different physical properties, by controlling the polymer formation. Curme and Douglas[1] published data showing how some of the physical properties of the thermoplastic resin "vinylite" varied with the polymer length. These investigators demonstrated that impact strength, tensile strength, modulus of elasticity and

*A report to the Research Commission of the American Dental Association. (Publication authorized by the Executive Board of the Research Commission.)

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modulus of rupture of the vinyl resin increased with the average length of the polymers. The solubility and plasticity decreased with an increase in the length of the polymers.

A thermoplastic resin suitable for dentures should have the following properties: (1) uniform composition for various lots of resin; (2) uniform softening temperature; (3) sufficient plasticity at the recommended molding temperature to mold without introducing excessive strain in the finished product; (4) chemical stability at the temperatures at which it is moldable.

1. *Uniformity of Composition.*—As the physical properties of this type of material depend to a great extent on the polymers present, a determination of the polymer distribution may be used as an indication of the uniformity of different lots of resin.

Douglas and Stoops[2] published a method for determining the polymer distribution of the vinyl resins which has proved satisfactory for the present work and has been used for determining the polymer distribution of samples of resin taken from (1) new denture blanks; (2) dentures which had given satisfactory service; (3) dentures which failed in service; (4) repair sticks, and (5) a clear unpigmented resin of a denture grade.

The results in Table 1 show that the dentures investigated had a wide variation in polymer distribution although they were sold as the same material. Although it is impossible to say which of the foregoing distributions are most desirable or even to predict from the foregoing experiments that certain resins failed, because of the type of polymers, it is logical to assume that some of the difficulties which have been encountered may be due to the use of a non-uniform material.

Table 1.—Polymer Distribution of Vinyl Resins Used for Denture Base Material

Specimen	Molecular Weight					Remarks
	Fraction I 20,000 to 16,000	Fraction II 16,000 to 12,000	Fraction III 12,000 to 8,000	Fraction IV 8,000 to 4,000	Fraction V 4,000 or Less	
	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	
1. Repair stick	1.4 1.8	42.9 44.1	35.4 33.8	17.7 17.6	2.6 2.6	Duplicate tests
2. Clear resin	17.0	39.9	24.8	14.2	4.2	Not heated
3. Clear resin	20.2	36.9	24.2	15.0	3.8	Pressed at 145° C. for thirty minutes.
4. Clear resin	22.1	36.6	22.8	14.0	4.5	Not heated
5. Denture	46.5		32.3	18.3	2.8	Broke in service
6. Denture	5.5	45.5	30.9	14.8	4.0	Fractured in service through palatal area
7. Denture	4.5	45.6	30.6	16.4	2.8	Satisfactory in service
8. Denture	0.6	37.1	35.4	22.7	4.1	Satisfactory in service

2. *Softening Temperature and Plasticity.*—The softening temperature and plasticity of a resin are important in molding a denture in which the resin

must be pressed into small crevices between the teeth. Any difference in the foregoing properties for different lots of resin is of importance when objects are molded to an irregular shape.

The following experiments will show that two lots of vinyl resins known to have dissimilar polymer distributions have unlike softening temperatures and different flow properties.

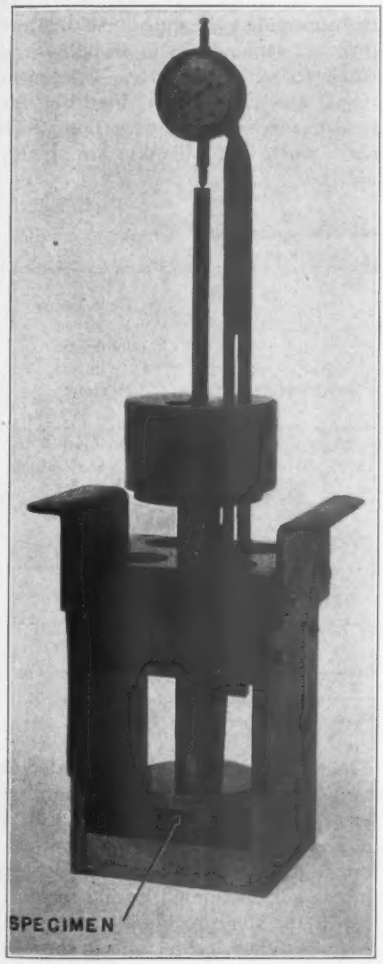


Fig. 1.—Instrument for determining molding characteristics of resins.

For these experiments, cylindrical specimens were machined to 8 mm. in diameter and 6 mm. in length. These specimens were placed in an instrument (Fig. 1) so constructed that various loads could be applied axially to the specimen while immersed in an oil bath the temperature of which could be raised at a definite rate or maintained constant. A sensitive dial gage mounted vertically and in contact with the top of the plunger was used to measure the flow. For the following tests, the specimens were heated to 150° C. at an approximately uniform rate as shown in Figure 2. During the heating, the flow of the specimen under a definite load of 1,280 gm. was observed on the dial indicator. By this procedure, the amount of flow in a given time, as well as the temperature at which rapid flow began, was determined.

The results of typical tests on the two lots of resin are shown in Figure 2. (Curve 1 is specimen 4; Curve 2 is specimen 1 of Table 1.) It may be seen, from an inspection of these curves, that the temperatures at the time the two resins began to flow were not the same and the rate, as well as the amount of flow for a given time and temperature, was different for the two resins. For example, the flow at 130° C. was approximately 31 per cent greater for specimen 2 than for specimen 1.

It is evident from these curves that the resin represented by curve 1 is less plastic than the resin represented by curve 2, and that to mold these resins to the same extent, at a given temperature and time, a greater pressure would be required for the less plastic resin.

Molding at a higher temperature or for a longer time at the recommended temperature would no doubt overcome to some extent the differences in plasticity. This, however, is not practicable with the

two resins investigated because of the instability of their color at temperatures higher than those recommended for molding, and for extended periods of heating at the recommended pressing temperature. If a denture is not uniformly heated throughout during the molding operation, a uniform product cannot be expected. A variation of 10 degrees C. has been observed in different parts of a denture, when the molding was done with the manufacturer's recommended equipment.

3. *Strain.*—The third necessary molding characteristic is that the thermoplastic resin shall be sufficiently plastic at the molding temperature to mold without introducing excessive strain.

In the foregoing experiments on flow, it was observed that all of the disks resulting from pressing small cylindrical specimens were irregular in shape. Specimens D, E, F and G, Group 3, Figure 3, are typical examples. Furthermore, it was observed that the type of irregularity in some cases was dependent on the direction in which the cylindrical specimens were cut from the resin sample. The irregularity of these specimens was attributed to the presence of residual strains in the material. This was confirmed when the disks were examined in polarized light.

Strain is present in the material when received from the manufacturer, as was demonstrated by heating new denture blanks and repair sticks in an oil bath at 130° C. for thirty minutes. Specimens B, C, D and E, Group 1, Figure 3, are typical examples of the distortion which occurs when the blanks are highly strained.

TABLE 2.—AMOUNT OF CURING OF PHENOL-FORMALDEHYDE RESINS (AS MEASURED BY DECREASE IN SOLUBILITY IN ACETONE)

Material	Storage		Decrease in Solubility in Acetone
Phenol-Formaldehyde Resin	Time	Temperature	
	Days	Degrees C.	Per Cent
H1	29	−60	None*
	42	0	None*
	25	37	34
	40	37	52
	25	72	98
H2	45	0	None*
	45	37	3
H3	60	0	None*
	60	37	50

*Values less than 1 per cent are reported as "none."
The values for solubility are considered good to ± 1 per cent.

These experiments were repeated as above, with finished dentures received from various sources. Specimens B, C and D, Group 2, Figure 3, show that strain is present in the finished denture and was not eliminated during molding. As with the denture blanks, strain was present in different directions in the various completed dentures which were examined. For example, in one case, the denture opened up in the posterior portion, whereas in others there was a tendency to close. Other samples showed vertical deformation.

In a few cases, it was observed that cracks developed in the samples heated to 130° C. in an oil bath. Figures 4 and 5 show a denture and a test specimen, respectively, in which such cracks appeared.

An attempt was made to remove the strain by heat-treating denture blanks and thin disks of the resin by storing them at temperatures a few degrees below the molding temperatures for one or more days. Other samples were gradually heated from room temperature to the 130° C., during which time they were continuously observed in polarized light for any change in the amount of strain. Neither of the foregoing procedures removed the strains. In these experiments, strain-free specimens were not produced during either the molding or the heat treating of these resins at the recommended molding temperatures or at higher or lower temperatures.

It is conceivable that many of the failures which have been observed in the use of this material may be the result of trying to mold a highly strained blank under conditions which are not suitable for producing a strain-free finished product. Undoubtedly, in some cases, more strain is present than in others, and in those cases which are highly strained, added external forces, below the normal tensile strength of the material and applied in the direction of the strain, may be sufficient to cause fracture. Specimens C, D and E, Group 4, Figure 3, are typical examples of the glassy fracture that is found in many cases.

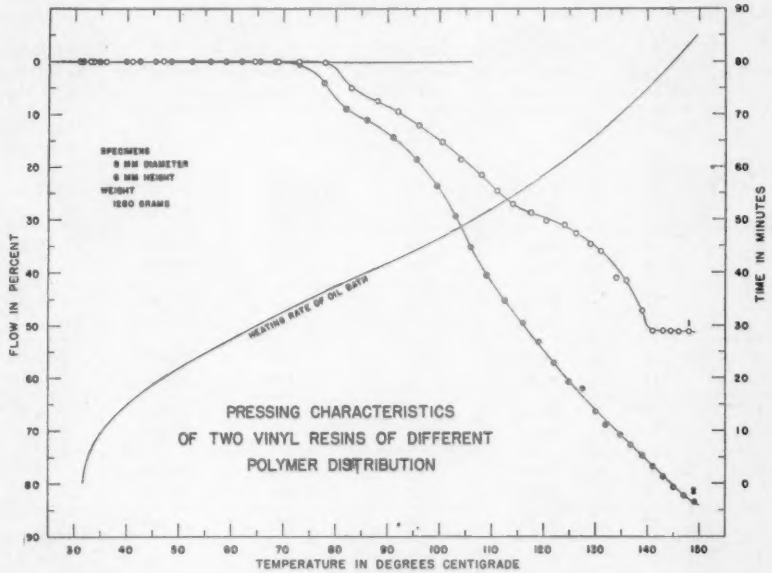


Fig. 2.

4. *Color.*—The fourth prerequisite of a thermoplastic resin for dentures is that it shall be chemically stable in the region of the molding temperature. The above-mentioned resins failed to some extent in this respect, in that they cannot be molded at temperatures much higher than those recommended for molding, or even for any extended time at the molding temperature, without becoming darkened. The darkening occurs in both the

pigmented and the unpigmented resin; which indicates instability of the resin rather than the pigment used.

III THERMOSETTING RESINS

The thermosetting resins are those which, although softened by the initial application of heat, are permanently hardened by continued heating and are thereafter no longer capable of being softened by reheating. This class of resins undergoes a chemical reaction in the mold.

Thermosetting resins, of the phenol-formaldehyde type, like the thermoplastic resins, may be considered as being composed of bundles of large molecules, but, in this case, molecules which are capable of joining each other during molding. This process of joining is an irreversible chemical reaction and, as this reaction progresses, the resin becomes less soluble and less plastic, and it is finally converted into an insoluble infusible solid. The chemical changes which occur during the manufacturing and molding of these resins may be divided into three phases,[3] which have been referred to as A, B and C. Phase A is the result of the initial condensation. The phenol-formaldehyde resin in this state may be a liquid, a paste or a solid, these resins are soluble in alcohol, acetone, phenol, glycerol and similar solvents and are converted into phase B by heating. Phase B resins are solid at all temperatures and are insoluble in all solvents, but may swell in acetone, phenol or terpineol without entering into complete solution. If heated, they do not melt, but become elastic and rubber-like. On cooling, they are again hard and brittle. Further heating converts phase

Table 3.—Color Specifications of Phenol-Formaldehyde Resin H1 For Different Curing Conditions

Specimen	Stored for 45 Days	Portion of Specimen Viewed	Time of Curing at 130° C.	Trilinear Coordinates* (Chromaticity)		Apparent Reflectance† A/A MgO
	Degrees C.		Hours	x	y	(Lightness) Per Cent
1	0	Front	1½	0.398	0.326	21.0
	0	Back	1½	0.396	0.325	
2	0	Front	1½	0.388	0.324	20.8
	0	Back	1½	0.391	0.325	
3	37	Front	1½	0.426	0.344	18.8
	37	Back	1½	0.439	0.352	
4	37	Front	1½	0.432	0.345	19.3
	37	Back	1½	0.438	0.349	
5	0	Front	2½	0.435	0.346	18.0
	0	Back	2½	0.438	0.344	
6	0	Front	2½	0.424	0.340	18.4
	0	Back	2½	0.435	0.344	
7	37	Front	2½	0.482	0.363	16.7
8	37	Front	2½	0.482	0.362	16.7

*Expressed in coordinate system recommended by International Commission on Illumination in 1931. (Observations by D. B. Judd of the Colorimetry Section of the National Bureau of Standards.)

†Specimens compared with magnesium oxide, viewed at 45 degrees and illuminated normally.

B resins into phase C resins, which are infusible, insoluble in all solvents, unattacked by acetone and indifferent to ordinary acids.

It is well known that some of the phenol-formaldehyde resins used in dentistry undergo cure slowly at temperatures well below those recommended for molding, and that some of these resins deteriorate when stored at room temperature. The following experiments have been designed to determine (1) how stable these resins are when stored at temperatures likely to be encountered in shipping or in the dental laboratory; (2) to what extent a partial cure caused by storage will affect further curing and the physical properties of the finished denture, and (3) at what temperatures these resins begin to undergo cure rapidly during molding.

1. *Stability of Phenol-Formaldehyde Resins at Temperatures Below Those Recommended for Curing (Shelf-Life).*—Three phenol-formaldehyde resins, H_1, H_2 and H_3, were investigated. The resins were stored at −60, 0, 37 and 72° C., for various periods. A method based upon the experimental fact that the solubility of the phenol-formaldehyde resins in acetone decreases as curing progresses was used to determine whether the resins were cured at these temperatures. Briefly, the method is as follows: Samples of a resin purchased were ground to pass a No. 30 sieve. The percentage solubility of this material in acetone was determined. Specimens of the ground resin

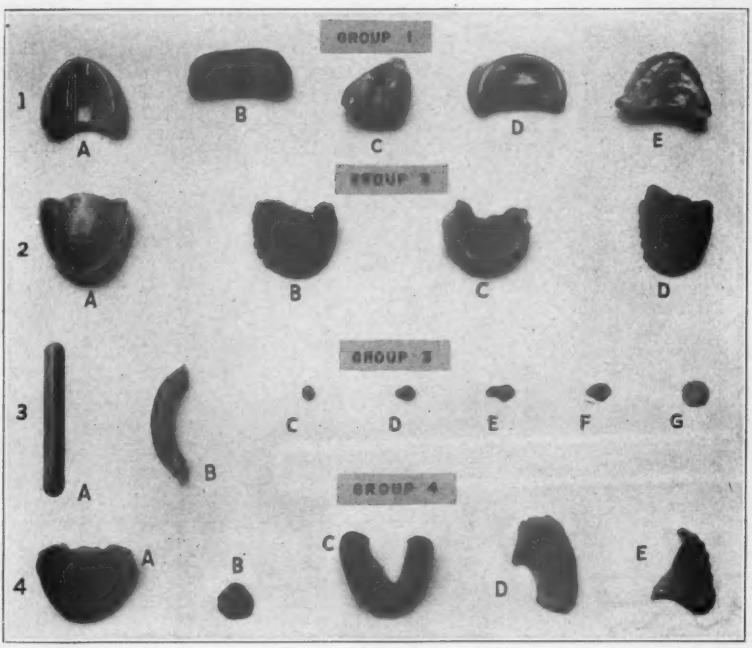


Fig. 3.—Typical examples of distortion and fracture caused by strain present in vinyl denture resins. Group 1. Denture blanks. Group 2. Finished dentures. Group 3. Repair stick and cylindrical test specimens. Group 4. Fractured dentures and test specimens. All the distorted specimens were heated to 130° C in an oil bath. Specimens A, Groups 1, 2 and 3, and specimen C, Group 3, are untreated (not heated) specimens.

were then stored at various temperatures or cured for definite intervals, after which their solubility in acetone was again determined. The decrease in solubility was used as an index of the amount of change which had occurred either from storage or from curing at the various temperatures.

2. *Effect of a Partial Cure on Further Curing (Overcuring, Color and Cross-Bend Values).*—Experiments were made to determine (1) the rate of curing of resins H1, H2 and H3, which had been stored at 0° and 37° C.; (2) the effect of storing these resins at 37° C. on color, etc., of the finished product, and (3) the

TABLE 4.—RATE OF CURING OF PHENOL-FORMALDEHYDE RESINS DURING PERIOD REQUIRED TO HEAT FLASK TO CURING TEMPERATURE AS MEASURED BY SOLUBILITY OF RESIN IN ACETONE

Sample	Material	Recommended Curing Temperature	Initial Solubility	Temperature of Oven* at Time Sample Was Removed	Time Required to Heat Oven to Temperature Indicated	Solubility After Heating	Decrease in Solubility
1	Phenol-formaldehyde Resin H1	Degrees C 130	Per Cent 88	Degrees C 113	Minutes 30	Per Cent 89	Per Cent − 1
				130	45	45	43
2	Phenol-formaldehyde Resin H1	130	88	74	15	88	0
				102	30	88	0
				122	45	53	35
				130	60	27	61
				131	90	10	78
				131	120	8	80
				131	180	6	82
3	Phenol-formaldehyde Resin H2	131	100	79	15	99	1
				113	30	30	70
				130	45	27	73
4	Phenol-formaldehyde Resin H3	116	77	79	15	70	7
				113	30	28	49
				130	45	4	73
5	Phenol-formaldehyde Resin H3	116	90	70	15	81	9
				99	30	72	18
				114	45	64	26
				114	60	49	41
				115	90	22	68
				115	120	16	74
				115	150	13	77

*Initial temperature of oven was 30° C.
The values for solubility are considered good to ± 1 per cent.

The data given in Table 2 show that (1) no appreciable curing occurred in the samples stored at −60 and 0° C.; (2) two of the resins, H1 and H3, were partially cured by storage at 37° C.; (3) resin H2 was only slightly affected at 37° C., and (4) one of the resins, H1, was definitely overcured when stored at 72° C. for twenty-five days.

effect of undercuring on cross-bend values.

(a) Rate of curing: Samples of resins H1, H2 and H3, which had been stored at 0° and 37° C. for various periods, were ground to pass a No. 30 sieve, placed in aluminum boats and heated in an electric oven. Specimens were removed from the oven at fifteen-minute

intervals after the recommended curing temperature was reached. The specimens were then ground to pass a No. 30 sieve and the solubility of weighed portions of each resin in acetone was determined. The decrease in solubility was used as an index of the amount of cure which had taken place.

Figure 6 shows the decrease in solubility of these resins with an increase in time of curing. In general, the solubility decreases rapidly in the earlier stages of cure and becomes more or less constant in the latter stages. For example, curve 3 of Figure 6 shows the decrease in solubility of resin H_3 stored at 0° C. and curve 6 shows the decrease in solubility for the same resin stored at 37° C. The effect of storage on the solubility of this resin is very pronounced, as is indicated by the differences in solubility at the time the curing temperature was reached and throughout the later stages of cure. Curves 4 and 5 for resin H_1 follow in general the curves obtained for resin H_3.

Curves 1 and 2 for resin H_2, however, are decidedly different from the other curves in that only a slight change in solubility or cure occurred during this period; which indicates that the resin was practically cured during the period of heating required to bring the resin to the recommended curing temperature.

The residues obtained in the solubility measurements on resin H_2 were very different from those obtained from resins H_1 and H_3 in that a waxlike substance was always present in H_2 residue.

Fig. 4.—Cracks which appeared in strained denture heated to 130° C. in oil bath.

(b) Color and overcuring: It was observed in the foregoing experiments that the color of the specimens which had been stored at 37° C. and cured according to the manufacturer's recommendations was decidedly different from the color of the specimens of the same resin stored at 0° C. Further experiments were made in which four samples of

resin H1 were treated in duplicate in the following manner. Four of the specimens were partially cured by storage at 37° C. for forty-five days. Two of these specimens were then cured for one and one-quarter hours and two for two and one-half hours. Specimens which had been stored at 0° C. from the time of purchase were also cured in duplicate as above for one and one-quarter and two and one-half hours. The colors of the four samples were then compared by the method adopted by the International Commission for Illumination.[4, 5] The data from these experiments are shown in Table 3. The colors of specimens stored at 37° C. and cured for one and one-quarter and two and one-half hours respectively were different from those of the specimens stored at 0° and cured in the same manner.

The color of the resin stored at 37° and cured for one and one-quarter hours could not be distinguished from the color of the resin stored at 0° but cured for two and one-half hours. The color of the resin stored at 37° C. and cured for two and one-half hours was decidedly different from the colors of either of the above-mentioned specimens, being yellowish red and resembling the colors of specimens definitely overcured. The color of the specimen stored at 0° C. and cured for one and one-quarter hours was different from all of the above-mentioned colors obtained in that it was more bluish (undercured).

These experiments show that with these specimens, storage at 37° C. for forty-five days was equivalent in color change to one and one-quarter hours of curing at 130° C. and that shelf life was an important factor in the color of the finished denture.

Fig. 5.—Cracks in highly strained test specimen heated to 130° C. in oil bath.

Reflectance measurements made on the same specimens verified the fact that storage conditions affect the appearance of a finished denture. The Hunter Photo-Electric Reflectometer,[6] which measures the apparent reflectance of the material relative to that of magnesium oxide, showed that the specimens stored

at 0° C. and cured for one and one-quarter hours had the highest apparent reflectance, whereas those specimens stored at 37° C. for forty-five days and cured at 130° C. for one and one-quarter hours had approximately the same apparent reflectance as the samples stored at 0° C. and cured for two and one-half hours at 130° C. The samples stored at 37° C. for forty-five days and cured for two and one-half hours at 130° C. gave the lowest relative reflectance values.

The specimen was supported over a 50 mm. span and loads were applied in the middle of the span by the addition of weights to the weight pan at 500 gm. per minute at room temperature. The deflection was measured by a dial indicator as shown in Figure 7.

The results (Fig. 8) show that a resin cured for two and one-half hours had a greater modulus of elasticity or greater resistance to deformation for a given load than the same resin cured for one

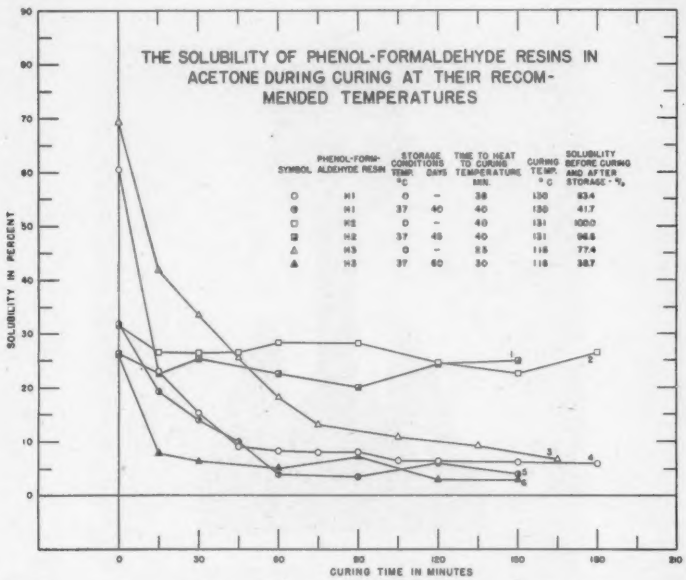


Fig. 6.—Progress of cure of phenol-formaldehyde denture resins heated at recommended curing temperature, as measured by solubility in acetone.

The data from these experiments are given in Table 3.

(c) Cross-bending: In order to demonstrate the effect of curing on the mechanical properties of these resins, cross-bend tests were made on resin H1 in the following manner: Specimens (2.5 by 10.0 by 65 mm.) were machined from plates of resin which had been cured at 130° C. for one and one-quarter and two and one-half hours, respectively. and one-quarter hours. For example, at a load of 6,000 gm., the deflection for the specimen cured for one and one-quarter hours was about 25 per cent greater than for the specimen cured for two and one-half hours.

3. *Curing of Phenol-Formaldehyde Resins Which Occurs from Time Resin Is Softened by Initial Application of Heat Through Time Required to Pack and Close Flask.*—It is essential in this

initial period of curing that the rate of curing be such as to give ample time for proper packing of the flask. During this period, the flask must be maintained at a temperature below that at which rapid curing of the resin begins. For example, a resin which undergoes rapid cure at a temperature slightly above its softening point may be cured to such an extent during packing that the air entrapped in packing cannot escape, causing bubbles in the finished denture. Further, in such a resin, rapid curing may take place on the hottest surface of the flask and cause cracking of the denture when force is applied.

The curing that occurs in this packing period and its effect were investigated by the method previously described for determining the curing which occurred during storage at various temperatures. Resins H1, H2 and H3, which had been stored at 0° C. from the time of purchase, were used. Samples of the above-mentioned resins were ground to pass a No. 30 sieve. Weighed portions of each were placed in an electric oven in aluminum boats and heated gradually to the recommended curing temperature. Samples of each of the resins were removed from the oven at fifteen-minute intervals after heating was started and their solubility in acetone was determined. The decrease in solubility from one fifteen-minute period to the next was used as an index of the amount of curing which had occurred during that period.

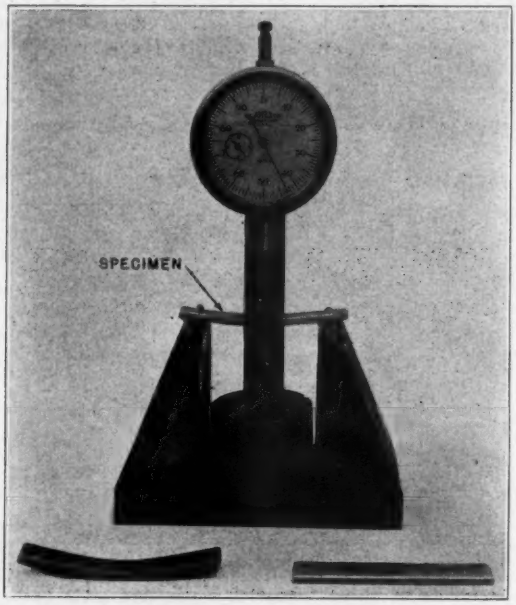


Fig. 7.—Instrument for measuring cross-bend properties of denture base materials.

The data in Table 4 show that the three resins were only slightly cured in the first fifteen minutes of heating, during which the temperature of the oven went from approximately 30° C. to 75° ±5 degrees C. However, in the second fifteen-minute interval, during which the temperature of the oven increased to a

maximum of 113° C., two of the resins, H2 and H3, began to be cured rapidly. In the third fifteen minutes of heating, all of the resins were being cured rapidly.

From these results, it may be concluded that resins H2 and H3 must be worked below 80° C. and that pressure must be applied to the mold soon after a temperature of 80° C. is reached. Otherwise, curing may progress to such an extent that cracks or bubbles will appear. For example, in an attempt to mold flat plates of resin H3, a specimen was packed and the pressure was applied to the material fifteen minutes after heating was started. The resulting plates were badly cracked. Satisfactory plates were made, however, when the force was applied before the resin had reached the temperature at which rapid curing was taking place.

Other experiments were made on samples of resins H1, H2 and H3, which had been stored at 37° C. for forty-five days. As in the foregoing experiments, ground samples of the resin were placed in aluminum boats and heated in the drying oven. Three observations were made: (1) Resin H3 failed to melt at any time during the heating; (2) resin H1 melted, although it did so at a much slower rate than those samples of this resin which had been stored at 0° C.; (3) resin H2 melted in the normal manner; which is further confirmation that this resin is not appreciably affected by storage at 37° C.

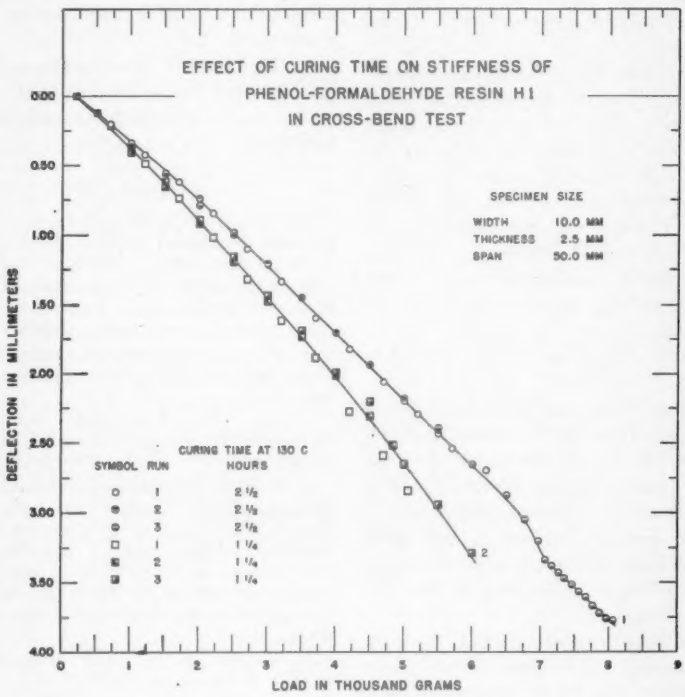


Fig. 8.

SUMMARY AND CONCLUSIONS

In general, these experiments have demonstrated a number of factors in the properties of the resins, as well as in the molding technic, which can seriously affect the finished denture. It is our opinion that, in many cases, failure was not entirely the result of the use of faulty materials, but was rather the result of the failure of the manufacturer to supply adequate information on the properties of the material, including normally expected variations encountered in the dental laboratory.

For example, the previous experiments have shown that the thermoplastic vinyl resins which were investigated (1) are not uniform as regards composition, (2) do not have uniform softening ranges and flow properties, (3) are not strain-free either before or after molding and (4) are not stable with regard to color for prolonged periods at the recommended molding temperature and are quite unstable at the slightly higher temperatures likely to be encountered in practice.

The experiments on the three thermosetting resins have demonstrated that:

1. Two of the three resins may be partially cured at temperatures likely to be encountered in storage and shipping.

2. The partial cure which can occur during storage will affect further curing and the physical properties of the finished denture.

3. The temperature at which the various resins begin to undergo rapid cure is different for the three resins and these temperatures are important in that they limit the time and temperature permissible for packing and closing the flask.

4. Overcuring and undercuring of these resins affect such physical properties as color and stiffness of the finished denture.

5. The color (chromaticity) of denture materials may be quantitatively measured on a colorimetric coordinate system recognized by the International Commission on Illumination, and, together with the relative reflectance, will satisfactorily determine the esthetic appearance of the material.

6. The method of solubility in acetone may be used for determining the amount of cure of a phenol-formaldehyde denture resin.

BIBLIOGRAPHY

1. Curme, G. O., Jr., and Douglas, S. D.: Resinous Derivatives of Vinyl Alcohol. *Indus. & Eng. Chem.*, 28:1123, October 1936.

2. Douglas, S. D., and Stoops, W. N.: Polymer Distribution in Vinyl Ester Resins. *Indus. & Eng. Chem.*, 28:1152, October 1936.

3. Ellis, C.: Chemistry of Synthetic Resins. New York: Reinhold Publishing Corporation, 1935.

4. Proc. 8th Sess. Com. Internat. de l'Éclairage, Cambridge, September, 1931, pp. 19-29.

5. Judd, D. B.: Subtractive Colorimeter for Measurement of Small Chromaticity Difference Between Surfaces of Moderate Spectral Selectivity of Reflectance. *J. Opt. Soc. America*, 26:225, 1936; Calibration and Use of Subtractive Colorimeter for Small Chromaticity Differences on Standard ICI System. *Ibid.*, 26:304, 1936.

6. Hunter, R. S.: Null Method Photoelectric Reflectometer. *J. Opt. Soc. America*, 26:225, 1936; *Bull. Am. Ceramic Soc.*, 15: 79, 1936; *Better Enameling*, 7:12, 1936.

BUREAU OF PUBLIC RELATIONS

CONNECTICUT TRIES CONTINUITY BROADCASTS

By R. Bullock Jones, D.D.S., Willimantic, Conn.

JUST a short time ago, Bob Steele, a radio announcer on the staff of WTIC in Hartford, Conn., stepped up to a microphone and said:

You have just heard the last in the present series of monthly talks presented by the radio counselor of the Connecticut State Dental Association, in cooperation with the Hartford Medical Society. The Association hopes you have enjoyed these talks and that many of you have been helped by them. Until next Fall, then, the Connecticut State Dental Association bids you goodbye and wishes you a pleasant Summer. This program, heard over stations WICC in Bridgeport and WTIC in Hartford, originated in the studios of WTIC.

With these words, the Connecticut State Dental Association had finished a series of monthly broadcasts that were experimental in many respects. In a hope that some of the things learned by the radio control committee of the state Association may be of help to other dentists or committees who may at this very moment be planning radio programs, I shall describe some of the work being carried on here.

First of all, I want to tell you briefly about Connecticut's broadcasting facilities. There are several excellent broadcasting stations in the state, but it also has one station with 50,000 Watt power. This station (WTIC owned and operated by the Travelers Insurance Company, Hartford) has had supremacy on the air in its territory through the policies of the management which at all times have kept the station abreast of the radio industry in equipment and program quality. At the same time, the men of WTIC have carried into broadcasting the tradition of public service. This tradition made it possible for the Connecticut State Dental Association to secure (without cost) a monthly broadcasting period of fifteen minutes. Incidentally, if the state society had to buy this time, it would cost $144 per broadcast.

Just as with the stations in Illinois, a contour outline has been made of the area supplied by this station. This outline shows that the primary and secondary areas contain 737,700 radio homes supplying 3,058,587 people. (Statistics are boresome, so I'll get to the point quickly.)

In 1937, a Ross-Federal Survey was made of this station's audience, covering all periods from 8 a.m. to 9 p.m., and it shows that during our broadcast period on Saturday at 6:45 p.m., there is a potential listening audience of 55 per cent. In other words, if our programs click, we have the privilege of talking to over a million and a half New England citizens.

Now, it is not my intent to make this report a personal one, but for just one paragraph, may I?

The officers of our state society were made fully aware of the tremendous edu-

cational possibilities of our radio time by the studious interest of one man. I refer to Earle S. Arnold the chairman of our radio control committee. Incidentally, Dr. Arnold dislikes publicity of any sort, so I hope he will not read this report. However, he had watched radio development over a period of ten years, and he began to realize the weaknesses in our approach to this golden opportunity and, fortified by the strength of his convictions, he took his opinions to the board of governors of the state society. The results were twofold:

First, the state officers abolished the custom of appointing the members of the radio control committee geographically. The appointees selected live in the Hartford area and were easily available for frequent meetings. This resulted in a committee that functioned as a unit and took some of the burdens of management from the chairman's shoulders.

Second, one man was selected to write and deliver all the broadcasts. Such an arrangement permits a continuity of program and educational effort. It permits the entire year's program to be prepared in advance, with the result that the material can be controlled and made to dovetail with any phase of educational instruction that may seem most important to the board of governors. For example, it was decided last year that our broadcasts should include some activity which would promote the dental education of children throughout the state. A simple letter contest was arranged whereby the children going to school in Connecticut were asked to answer one dental question each month. The question was announced during each broadcast and three prizes were awarded for the best answers of 100 words or less. The prizes were $5, $3 and $2, and the first prize-winner was invited to appear for presentation over the air during the subsequent broadcast. We believe that these monthly contests increased the dental knowledge of at least 1,000 boys and girls; and every member of our radio control committee will argue till dawn with any dentist who thinks such an end-result is not worth the small cost. Contests, of course, are not officially approved by educators as a means to an end, but in these days of really exciting radio entertainment for children, with prizes for everything under the sun, we voted in favor of practicability. Discernment in educational methods is unquestionably important to educators, but we have a dental message to deliver, and either we meet our competition on the radio or else we accept a greatly disminished children's audience.

However, here's the essence of what I wished to say: I believe the time has come when every state society should adopt a definite radio educational policy and then carefully study the geographic distribution of radio service in that state. Sustaining programs should be procured from those stations which thoroughly cover the state. Only in this way can each association utilize to the fullest extent the opportunity provided by radio for instruction in dental prevention.

What is the dental profession doing for the betterment of the dental condition of the masses? Connecticut thinks a strong program of radio education is in part the answer.

FIVE STATE POST GRADUATE CLINIC DENTAL SOCIETY OF THE DISTRICT OF COLUMBIA

RADIO BROADCAST

This broadcast is an excellent example of how the radio can be employed for both publicity and educational purposes. Dr. Lynch publicized the Five State meeting and helped educate the public at the same time.

MUSIC: Londonderry air fading for—

ANNOUNCER: Today, we are to hear a dental talk by Dr. Daniel F. Lynch, secretary of the Research Commission of the American Dental Association. Doctor Lynch.

DR. LYNCH: Ladies and gentlemen of the radio audience, have you tried to make an appointment with your dentist this week? If you have, you probably found that he is not in his office. He is very likely attending the Five State Post Graduate Clinic at the Mayflower Hotel. In reality, he is going to school again. He is returning in order that he may learn of the new scientific advances in dentistry of the past year so that he may better serve you. The Five State Post Graduate Clinic is a sectional meeting of the American Dental Association. It began in Washington six years ago when the District of Columbia Dental Society decided to invite the dentists in the neighboring states to attend their annual clinic. The affair has grown to such importance that dentists from New England, the far south, the middle west and the far west often attend the sessions. The courses are intensive and comprehensive. This morning Dr. Rudolf Kronfeld, professor of histopathology at Loyola University, Chicago, Ill., reported on his work in histopathologic research. His report dealt with the teeth and their supporting structures. You may very readily ask, How does this benefit me? I should like to cite an example which may have been a sad experience of your own; one in which you and possibly your dentist would not have known what to do. Suppose Jimmy has been playing baseball or roller skating with the rest of the youngsters in the neighborhood and he has fallen down and knocked his upper front tooth loose and free of the tooth socket. What is to be done about it? Dr. Kronfeld says that his experiments on animals and his clinical research on patients, plus the proof of microscopic studies, have definitely convinced him that certain teeth can become reattached to the tooth socket once the tooth has been dislodged from the tissues. This is not true in all cases, but it happens in a sufficient percentage of them to justify this effort toward saving the tooth. Most teeth which have been knocked out of the sockets become pulpless or dead. But they do not necessarily have to be extracted: they may be treated by your dentist and preserved safely for a number of years. Later on, for reasons of health, it may be necessary to remove the tooth, but during a child's formative years, when the facial outlines are developing, a pulpless tooth which has been successfully treated can safely be retained in certain cases, thereby helping to round out the full facial outlines and to give to the child the normal features which were intended for him.

Teeth can be fractured or broken the same as bones. If a tooth is fractured, is it necessarily lost? Dr. Kronfeld says no. The answer depends on the position and the degree of fracture. If the fracture occurs in the root portion of the tooth, that is, the part that is embedded in the gums, there is a good chance that the tooth will not lose its pulp, but will remain a useful member of the chewing apparatus. However, if the tooth is fractured in the crown or the enamel portion

of the tooth which is visible to the eye, there is less chance of saving it, especially if the fracture involves the nerve. When the nerve is killed, the whole tooth is seriously damaged. Dr. Kronfeld recommended that shortly after such accidents, the injured tooth be put at rest and held in fixed position in order to help heal the fracture and to restore the usefulness of the tooth. These are only some of the subjects which Dr. Kronfeld considered this morning, and they give to you an idea of the value of such a lecture.

This afternoon, Dr. Albert J. Irving, of New York City, formerly a teacher at the University of Michigan, told how teeth can be filled with gold inlays that do not sacrifice large portions of the crown of the tooth. You have, I am sure, often heard people say that they felt their dentist was drilling big holes in their teeth in order to fill them. According to Dr. Irving's technic, the cavities in teeth can all be filled in one piece, that is, instead of having five or six small fillings in a tooth, the decayed areas can now be joined together and filled with one filling. This technic in dentistry is not new, but has been the practice of many dentists for some years past. Dr. Irving, however, has produced a type of restoration which allows for a minimum amount of tooth destruction while insuring the maximum amount of retention and usefulness of the filling. During the past ten years, great advances have been made in the materials used for filling and restoring teeth. Right here in Washington, at the National Bureau of Standards, the Research Commission of the American Dental Association employs four scientists who work in conjunction with Government scientists in testing all materials which are used for filling teeth in order that you may have only the best. By such tests, the American public is protected from the use of dangerous filling materials which might contain large amounts of arsenic or other injurious metals. Any dentist can secure, free of charge, the list of accepted materials with which to work, thereby employing for his patient the highest quality of materials which dental science can produce.

While I am now talking to you, Dr. Lon W. Morrey, of Chicago, is lecturing to the members of the clinic on the dental health of American youth. There are only about 60,000 dentists in the United States, and only about 20 per cent of the population receive dental attention. If all the people in America should suddenly decide to go to the dentist, there would not be enough dentists to take care of the people applying for service. The American dentists realize that, in the past, most of their attention has been given to repairing teeth which have broken down. They have been so busy doing this work that they have been unable to study the prevention of dental troubles. However, during the past three or four years, the American Dental Association has begun research on the problem of preventing the destruction of teeth. The dentist realizes that in order to achieve the ideal of perfect teeth for the average American citizen, it is necessary to begin with the children. It is even necessary to begin with the mother long before the child is born, because the character of the infant's teeth is determined by the type and kind of food which the mother eats. This diet of the mother even affects the second, or permanent, teeth of the children. Though the first permanent tooth does not erupt until the child is 6 years of age, the tooth-bud of this particular tooth is formed long before the child is born. Realizing these facts, the American Dental Association has created a bureau of public information, of which Dr. Morrey is the directing head, and he is reporting today on the work which his office has been doing. The results will be surprising and most

encouraging, for he will report that the mouths of the American children of today are far superior to the mouths of the children of fifteen years ago. In other words, the teachings regarding diet and mouth hygiene are beginning to show their effects. Just keeping the mouth clean isn't sufficient to insure good teeth: one must eat the proper kinds of food, rich in the minerals calcium and phosphorus. An ample supply of the vitamins A, B, C and D is also essential, and foodstuffs which have an abundance of these vitamins are desirable in the diet of every American child.

Tomorow, Dr. Alexander H. Paterson, professor of prosthetic dentistry at the University of Maryland, Baltimore, will teach your dentist the latest technic in the construction of full plates of artificial teeth. He will show that it is unnecessary for people to feel that they cannot wear artificial teeth once they have lost their own teeth. There are literally thousands of people who are living unhappy, unhealthy lives because they are carrying in their mouths infected teeth which are undermining their health. There are many reason for this, one of the most common being fear that if they lose their own teeth, they will be unable to wear artificial ones satisfactorily. They point to friends who carry their artificial teeth in their pockets because they are unable to wear them. Dr. Paterson says that this is unnecessary. If correct impressions are taken and if the new dentures are made to fit the individual mouth, all patients can have satisfactory artificial teeth. Of course, it takes time and great care to adjust the teeth to each individual mouth, and the patient must learn to use the artificial teeth once they are adjusted. Many patients have the impression that the false teeth will function automatically and they do not have to try to use them. Dr. Paterson will point out tomorrow that one of the main factors in the successful treatment of patients with dentures is to encourage them and teach them the proper function of dentures once they have been adjusted. Because an artificial tooth is white, it does not necessarily follow that it will look well in your mouth. The coloring of the skin has a great deal to do with the selection of the color of a tooth. In dark-complexioned people, the teeth will always look very white, whereas in persons of light complexion, the tooth must have a little shading in order to make it look natural. The selection of the tooth should be left to the dentist, as he will invariably select the one which not only is the right color for you, but is also of the correct form for the shape of your mouth and face. The dentist of today must truly be an artist, if he is to achieve the best esthetic results. Extensive postgraduate courses like those being held here this week enable your dentist to keep up with these advances in his science.

Tomorrow afternoon, Dr. Malcolm W. Carr, of New York City, and Dr. Oscar V. Batson, of Philadelphia, will discuss infections in the neck which are caused by bad teeth. They will show that a person can have severe throat and neck infections, which may have fatal results, if diseased teeth are neglected. The breaking of an abscessed tooth in the mouth is often a very fortunate thing for the patient, because it is just as possible for the abscess to have ruptured in the neck and tonsil region, or in the nasal sinus, with additional complications which are often extremely serious. Dr. Carr will emphasize the fact that patients should be encouraged to have infected teeth removed before they become painful. When a tooth begins to hurt, it is often too late to prevent a dangerous infection in other parts of the body. Once the infection has entered the blood stream and general circulation, the patient becomes seriously ill. Then it is only by the combined cooperation of the physician and the dentist that the patient can be brought back

to normal health. People should not delay when they have a toothache, but should go immediately to the dentist, and should not attempt home remedies. Often, the injudicious use of the hot-water bottle is the cause of an extensive swelling of the face. The hot-water bottle has its place, but is should be used only under the instructions of a competent physician or dentist. These and many other complicated and technical procedures are what your dentist has been studying this week at the Five State Post Graduate Clinic which is going on at the Mayflower Hotel.

Therefore, if you are unable to get an appointment with your dentist for a few days, recall that he is back at school learning the latest developments in his science.

NEW DENTAL EDUCATIONAL MATERIAL

ATTENTION is called to the following six pieces of dental health educational material which the Bureau of Public Relations, of the American Dental Association, has recently released. Every dentist interested in education of the public will want to use all of this material during the coming winter months.

1. Educational leaflets for the five- and the six-year old child. Prepared in cooperation with C. Carroll Smith, Peoria (Ill.) Public Schools, and Miss Sara McGiffert, Elizabeth McCormick Memorial Fund, Chicago, Ill. Tell your school superintendent about them. Order them for your school.

2. Newspaper dental health columns. A series of fifty-two articles, 350 words each, written in standard health column style. Each article deals with a specific dental subject. Component and district societies can use these in their local papers. A partial list of subjects is as follows: Dental Health for School Children; That All-Important Sixth-Year Molar; How the Permanent Teeth Form; Crooked Teeth and Orthodontia; Eruption of Baby Teeth; Diet and Care of Teeth; The Importance of Baby Teeth; Description and Functions of the Teeth; Dental Decay; The Dentist, Your Child and You; The Far-Reaching Value of Healthy Teeth. In mimeographed form, fifty-two articles, $2.50.

3. Syphilis—The Dentist's Part in the Program of Control. Compiled by R. A. Vondelehr, U. S. Public Health Service. A forty-page compilation of material on syphilis with special mention of its oral manifestations. Excellent material for every dentist to use in speaking before civic and luncheon clubs. Equipped with these facts, the dentist can materially assist in community syphilis control programs. Eighteen stereopticon slides illustrating oral and facial lesions accompany the lecture. Rental price of lecture and slides, $1 a day, $3 a week. Purchase price of compiled material without the slides, 25 cents.

4. Dental Health for the High School Student. A forty-minute stereopticon lecture especially designed for high school students. Deals with tooth development, diet, cleanliness, regular dental attention and the results of dental neglect. Thirty slides in the set. Rental price of lecture and slides, $1 a day, $3 a week.

5. Your Teeth and Your Health. An illustrated lecture for fifth to eighth grade classes, requiring about forty to forty-five minutes and dealing with fundamentals of dental health. Illustrations are furnished either in the form of forty-four colored slides or on 35 mm. film strip. Rental charge, $1 a day, $3 a week.

6. The American Dental Association's 1939 Appointment Book. Every member of organized dentistry will want one of these beautiful and practical books. Turn to page A-36 in the advertising section for a full description. Only a limited number of these books have been printed, so send in your order at once. Hundreds of our members were disappointed last year because they delayed too long. Price $1, with name gold stamped on cover, 25 cents extra.

Concordia, Kan. Kiwanians cooperating in Dental Poster Contest (rear) and fifteen winners displaying winning posters in Concordia contest.

Prize winners, prize posters and prizes, St. Louis (Mo.) District Poster Contest 1938. Left to right: William Preckel, first prize, 7th-8th grade classification; Dr. Leo F. Marre, Missouri State Chairman, National Dental Health Poster Contest. Dr. T. E. Kallenbach, Chairman, St. Louis Dental Society Districts, National Dental Health Poster Contest; Betty Lane, first prize, Junior high classification; Jack McNiff, first prize, vocational classification; Dr. William B. Spotts, member of the National Dental Health Poster Contest.

DENTAL ECONOMICS

NATIONAL HEALTH CONFERENCE

Washington, D. C., July 1938

THE fact that 300 individuals met in Washington, D. C., July 18 to 20 to discuss the health problems of the people is not in itself significant. Groups have gathered in the past for that purpose. They will gather again in the future. The significance of the July meeting lies in the fact that its participants were largely receptors, not purveyors, of health care. Former health conferences were attended largely by physicians and public health workers. They concerned themselves with the problem of providing more and better care to the laity. The July health conference was attended largely by laymen. They concerned themselves with demanding more, better and less expensive health service for society.

True, some time was spent in listening to the lengthy report of the Technical Committee of the President's Interdepartmental Committee to Coordinate Health and Welfare. Little time was spent in intelligently discussing it. Much time was spent in painting a picture of poverty and pain.

Miss Josephine Roche, chairman of the Interdepartmental Committee to Coordinate Health and Welfare, in opening the conference, presented a message from President Roosevelt. In his message, the President said:

I am glad that the conference includes so many representatives of the general public. The professional experts can, and, I feel sure, will do their part. But the problems before you are in a real sense public problems. The ways and means of dealing with them must be determined with a view to the best interests of all of our citizens.

I hope that your technical committee's report on the need for a national health program and its tentative proposals will be read and studied not only by the participants in the conference but by every citizen. Nothing is more important to a nation than the health of its people. Medical science has made remarkable strides, and in cooperation with government and voluntary agencies it has made substantial progress in the control of various diseases.

But when we see what we know how to do, yet have not done, it is clear that there is need for a coordinated national program of action. Such a program necessarily must take account of the fact that millions of citizens lack the individual means to pay for adequate medical care. The economic loss due to sickness is a very serious matter not only for many families with and without incomes but for the nation as a whole.

We cannot do all at once everything that we should do. But we can advance more surely if we have before us a comprehensive, long-range program, providing for the most efficient cooperation of federal, state, and local governments, voluntary agencies, professional groups, mediums of public information, and individual citizens. I hope that at the National Health Conference a chart for continuing concerted action will begin to take form.

The gigantic health program recommended by the Technical Committee on Medical Care to the Interdepartmental Committee to Coordinate Health and Welfare Activities proposes:

1. (a) Expansion of general public

health services, including intensified battling of tuberculosis, venereal disease and malaria, pneumonia, cancer and mental and industrial diseases; with a peak annual cost of $200,000,000.

(b) Expansion of maternal and child health services; peak annual cost, $165,000,000.

2. A ten-year expansion of the nation's hospital facilities by providing 360,000 additional beds, and by construction of 500 health and diagnostic centers in areas inaccessible to hospitals; total average annual expenditure, $146,050,000.

3. Free medical service, hospitalization and emergency dentistry for the medically needy who are self-supporting but unable to finance their own medical care; estimated cost, $10 per year for each individual; total expenditure, $50,000,000 the first year, gradually expanded to $400,000,000.

4. A comprehensive insurance program designed to increase and improve medical services for the entire population, with recommended financing by taxation, insurance contributions or both.

5. Temporary and permanent disability insurance, to assure workers continued income through period of illness.

A suggested program as presented by the Conference would cost the federal, state and local governments about $850,000,000 a year, half to be paid out of federal funds.

Planning a program of medical care of such magnitude must necessarily be approached as an objective to be fully attained only after some years of development, the conference was told. The rôle of the federal government should be principally that of giving financial and technical aid to the states in their development of sound programs through procedures largely of their own choice.

Commenting upon the Technical Committee's report, Miss Roche stated:

> The gross sickness and mortality rates for the poor of our large cities are as high today as they were for the nation as a whole a half a century ago. Among families on relief canvassed in the National Health Survey, acute illness is 47 per cent more prevalent and chronic illness 87 per cent more prevalent than among families with incomes of $3,000 or over. The average person in a relief family experiences three times as many days of disability annually as the average person in the upper income group. Non-relief families with incomes of less than $1,000 experience twice the rate of disability of families in the higher income group. One in every twenty family heads in the relief population is unable to work because of chronic disability, as contrasted with only one in 250 heads of families with incomes of $3,000 or over. No physicians' care is received in 30 per cent of serious disabling illnesses among relief families and in 28 per cent of such illnesses in families just above the relief level.
>
> The death rate among infants in families with incomes of less than $500 was more than five times the death rate among infants in families with incomes of $3,000 or more. Half of the two million babies born each year—a million babies—are born to families either on relief or with less than $1,000 annual income.
>
> Statistics show that 40 per cent of the counties in the United States, where 18,000,000 people live, have no registered general hospital; that more than two-thirds of the states have fewer general hospital beds than are considered adequate by professional standards.
>
> Workers in industry have a life expectancy approximately eight years less than non-industrial workers. A recent study in ten states showed that the death rate from all causes was more than twice as high for the unskilled worker as for the professional worker. For pneumonia, it was three and one-half times as high. For respiratory tuberculosis, it was seven times as high.
>
> The death rate from pneumonia in twenty-seven iron and steel manufacturing towns was 66 per cent greater than in the United States as a whole.
>
> A million workers are exposed in their daily jobs to the hazards of silicosis. About one-fourth of them already have silicosis in some stage—and with it an unusual susceptibility to tuberculosis. The prevalence of tu-

berculosis in a group of silicotics was found to be ten times greater than among the general population.

Fifty million Americans are in families receiving less than $1,000 income a year; illness and death increase their toll as income goes down; medical care decreases sharply as need for it mounts.

On an average day of the year, 4,000 or more persons in the United States are disabled by illness. Every year, 70,000,000 sick persons lose more than 1,000,000,000 days from work. The total cost of illness and premature death in this country is approximately $10,000,000,000 a year. This estimate includes only those factors which can be expressed in dollar values—the cost of health services and medical care, the loss of wages through unemployment resulting from disability, and the loss of potential future earnings through death.

We cannot attack successfully with small change a $10,000,000,000 problem. To carry forward a long-time program of health services and medical care commensurate with need will cost the government millions, but save the nation billions. It must be a program which not only safeguards but advances the quality of medical care.

Similar figures were quoted by other members of the conference purporting to show the need of subsidized medical care.

Dentistry was mentioned but briefly in the technical committee's report, although it was referred to repeatedly by many of the speakers.

Dr. Camalier, President of the American Dental Association, feeling the need of stressing preventive dentistry and the importance of including it in any national health program, presented a well balanced report. He said:

The American Dental Association has given serious consideration to this phase of the public health problem and believes that the logical approach is through adequate prenatal and postnatal nutrition and medical care, plus the detection and correction of dental defects early in childhood. This must be brought about largely through education. It has been demonstrated that if adequate dental service is provided the preschool child, the occurrence of complicated dental diseases will be materially reduced. If this type of program is followed, the ultimate cost to the community for proper dental service will be greatly minimized. The dental profession realizes that some provision must be made to provide emergency service such as the relief of pain and the elimination of infection at community expense for those adults of the present generation who cannot provide this service for themselves.

As previously stated, however, the dental profession believes that the long term program for children is the only feasible and practical program for the control of dental disease.

The three-day and one-evening session was crowded with reports and statistical data supporting the committee's contention that health services must be subsidized by the government. It was filled with emotional appeals from welfare workers and emphatic demands by farm and labor leaders for subsidized health service. Neither time nor space will permit the printing of these statements in full, but the following excerpts from some of the participants' speeches registers the atmosphere of the meeting.

Miss K. Lenroot, chief of the Children's Bureau: "In planning health service the needs of mothers and children require that they be among the first to be cared for. You are assembled here to consider the ways in which the elements in a national health program can be drawn together, helped to function and provided with adequate support. The traffic light is green. The time for major advance is at hand. We must go forward."

Thomas Parran, Surgeon-General, U. S. Public Health Service: "It is not unlikely that public health may be the next great social issue in this country."

Mrs. Dorothy J. Billanca, vice president, Amalgamated Clothing Workers of America: "The need of medical care falls unexpectedly with terrific force upon those who can least bear it. The need, inadequate, unmet, unpredictable, is beyond fulfilment by the low-income groups who most need it."

Ben Kilgore, chairman of the Medical Committee, American Farm Bureau Federa-

tion: "There is a vastly greater need for federal grants to build rural hospitals than for the excessive federal grants to build post-offices."

Mrs. H. W. Ahart, president of the Association Women of the American Farm Bureau Federation: "We are sixty years behind Europe to provide health insurance to the people of the United States."

Mrs. Ahart's association urged the extension of all forms of preventive medicine throughout the country and recommended a greater appropriation of funds, under the Social Security Act for the rural areas.

William Green, president of the American Federation of Labor, recommended the amendment of workmen's compensation laws to provide health and medical services to workers and their families. He recommended that workers help finance the health program plus grants in aid by the federal government and recommended free choice of the physician. He said that the American Federation of Labor's objective is to broaden workmen's compensation laws.

Lee Pressman, council for the C.I.O.: "It is the feeling on the part of labor that no program for adequate health facilities can possibly be administered unless it is administered through a Federal agency."

Mr. Pressman advocates that the national health program, including health insurance, be financed from general taxation, federal appropriations or payroll tax, but not a payroll tax on the income of employes.

Irvin Abell, president of the American Medical Association: The medical profession would be the last to deny the existence of medical needs in the United States. Its whole mission has been to fulfil those needs. Because of the variation of health needs according to localities and because of the present intensive system of providing medical services, it is believed highly important to determine the nature and extent of medical needs in every country in the United States. If the conference could develop a plan under medical control which would continually have the support, advice and approval of the physicians of this country for a better distribution of physicians, so as to provide for medical care of the indigent and near-indigent people where it is found necessary under plans locally approved, state by state, it will have accomplished a great deal not only for the preservation of scientific medicine, but also for the preservation of the lives and liberties and the happiness and effectiveness of our people."

Morris Fishbein, editor of the *Journal of the American Medical Association: "The* fundamental needs of mankind are food, fuel, clothing, shelter and a job, and medical care and dental care must always be subservient to those main human needs. Let us concern ourselves first with that question of food, fuel, clothing, shelter and a job with adequate wages.

Joseph A. Padway, general counsel, American Federation of Labor: "We believe there should be a compulsory plan which will afford to every human being needing it, within certain classifications, medical attention, wage compensation and the other elements that have been discussed here. . . . The plan should be placed within the Social Security Board. . . . I am talking for millions of people who are affiliated with the organized labor movement of America."

Charles W. Taussig, chairman of the Advisory Committee, National Youth Administration: "As head of an industrial corporation, I should like to emphasize that the expenditure of $850,000,000 for public health does not frighten business. Business bears a far greater financial burden now owing to our neglect of an adequate health control than its share of the tax burden will be under the proposed plan."

These are but a very few of the statements made by those in attendance. They are typical of many others. They serve to show the attitude of those in attendance. Undoubtedly steps will be taken at the next session of Congress to obtain legislation and money whereby this $850,000,000 a year health plan can function.

Dentistry was but lightly mentioned. However, if this gigantic health machine is put in operation, dentistry will be one of the teeth in the gears.

DENTAL PRACTICE IN CHICAGO*

By EDWARD J. RYAN, B.S., D.D.S., Evanston, Ill.

THE year 1929 is regarded by most economists as the golden era of national prosperity. That year, the national income in the United States produced a total of more than eighty-one billion dollars. A study made among the dentists of the United States indicated that the average net income from dental practice for 1929 was $4,820.[1] In the autumn of 1929, the national income in the United States began to drop rapidly, until in 1932 the total volume was thirty-nine and one-half billion dollars, or a decrease of more than 50 per cent from 1929. (Fig. 1.)

CHICAGO DENTAL SOCIETY SURVEY

The Economics Committee of the Chicago Dental Society, in an attempt to determine the impact of economic forces on dental practice, has made a study of dental incomes in Chicago for the years 1932 to 1936 inclusive. This report, made from that study, is intended to suggest the correlation between incomes in dental practice and the national income. The years 1932, 1934 and 1936 were selected for analysis because they represent three distinct epochs in the economic life of the nation. The year 1932 is described by economists as the low point, the depth of the valley of the financial cycle; the year 1934 represents the time at which the newer experiments in national planning were under way; whereas 1936 may be defined as the phase of beginning recovery. What happened to the dentists of Chicago during these years?

METHOD OF SURVEY

Before we interpret in detail the results of this study, it is necessary to comment briefly on the method of examination. A business post card, carrying four simple questions, was enclosed with a letter that was sent to the entire membership of the Chicago Dental Society. The questions were these:

1. What was your gross income from dental practice during the years: 1932, 1933, 1934, 1935, 1936 and (estimated) 1937?
2. What was your net income during 1932, 1933, 1934, 1935, 1936 and (estimated) 1937?
3. What activity should the Chicago Dental Society engage in to improve the economic conditions of its members?
4. To what branch do you belong?

In November 1937, when this study was begun, there were 2,513 members in the Chicago Dental Society, and probably an equal number of dentists in the Chicago area who were not members. Of this number, 401 returned the questionnaires, 287 of which were analyzed carefully. The 114 questionnaires that were eliminated were obviously arbitrary estimates of incomes and expense—round numbers that would have no validity in a statistical examination. Another way of saying this is that a little more

*Read before the Section on Dental Economics at the Seventy-Fourth Annual Midwinter Meeting of the Chicago Dental Society, February 17, 1938.

1. National Income in the United States, 1929-1935, U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce, Washington, Government Printing Office, 1935.

than 10 per cent of the dentists of the Chicago Dental Society returned questionnaires which were acceptable for analysis.

In the study made by the Committee on Dental Practice of the American Dental Association which analyzed the incomes of dentists in 1929, returns were received from 5,544 dentists. This was considerably less than 10 per cent of the total number of practicing dentists in the United States. We may say, then, that a 10 per cent return represents a fair sample for an examination of dental incomes.

CORRELATION BETWEEN BRANCH SOCIETIES AND DEVELOPMENT OF CITY

The Chicago Dental Society is divided into eight branch societies. The city of Chicago has developed in three directions: north, south and west. The lake is a natural barrier to expansion eastward. The earliest business location was at the mouth of the river. About this area, there has developed the present-day center of business life—the Loop. Progressing from this business center to the periphery, one passes through industrial neighborhoods and decadent areas (now the homes of low-wage earners) to more acceptable residential areas. The migration of the more fortunate economic classes of population is definitely outward from the center. Population may be considered to flow outward as families improve their economic status. This sociologic tendency is generally true in Chicago, with the exception of the near north side.

TYPES OF DENTAL PRACTICE

Dental practices in the Chicago area are of three general types: those in the Loop area; neighborhood practices, and suburban practices. Probably the most successful dental practices, from a money standpoint, are located in the Loop, because patronage is drawn from all sections of the city. The neighborhood practices, generally speaking, draw their patronage from persons in a circumscribed community. If the community is decadent, largely industrial or made up of low-wage earners, unfavorable economic conditions are likely to be reflected there more quickly than in those practices made up of the well-to-do. Suburban practitioners, for the most part, serve people who live in their own homes and have automobiles and other luxuries.

VALIDITY OF ESTIMATES

I anticipate that the criticism will be made that the figures for dental incomes to be cited are extraordinarily low. Unquestionably, many of the men in the higher economic brackets did not return the questionnaire. On the other hand, many of the dentists of extremely low income in the Chicago area who are not members of the society are likewise not represented. Some of the men in the higher earning brackets did not respond because they feared that any favorable showing of the dental income might result in legislation, the establishment of clinics or some form of governmental control. Even if the average incomes revealed in this study are regarded as basal and the low point in dental income is considered as the protestation of the disgruntled, the study is nevertheless extremely significant. To answer the argument that the figures to be cited are not accurate, reference may be made to the publication[1] by the United States Department of Commerce, "The National Income in the United States," wherein the per capita income of dentists is indicated as lower by about $250 than the average for the years 1929, 1932 and 1934; shown in the present study.

According to a survey made by the Chicago Dental Society, in 1932 the average net income of dentists in Chicago was $2,917.90; in 1934, $3,137.25; in 1936, $3,811.54. These figures should all be compared with the average net in-

come in the year 1929: $4,820. The dental income was reduced by 39.5 per cent in 1932 as compared with that of 1929. In 1934, the reduction was 35 per cent; in 1936, 21 per cent. Now to return to the government figures for these years:

In 1929, the per capita income of dentists was $4,564; in 1932, $2,785; in 1934, $2,787. (Fig. 2.) There are no figures for 1936. The loss of income among dentists in 1932 and 1934 was roughly 39 per cent as compared with 1929, according to the government figures. During the same period, the loss in national income was a little more than 50 per cent. There is no evidence that dental practice has returned to the 1929 levels. So far, reference has been made only to net incomes.

OVERHEAD

For the three years 1932, 1934 and 1936, the average gross incomes of dentists in Chicago was $5,547.32; the average net was $3,288.92, and the average expense was $2,258.40. It appears, then, that the expense in dental practice is 40.7 per cent. This figure is almost identical with the figures compiled by the Committee on the Study of Dental Practice in 1929, which indicated that professional expense absorbed about 41 per cent of the gross income of dentists. Despite general price levels, it appears that the expense of operating a dental office is almost constant as represented by the figure 41 per cent, although the percentage of expense tends to decrease as gross income increases. The variance, however, is negligible. For every dollar collected in dental fees in 1932, 42.4 cents went for expense. For every dollar collected in 1936, 39.1 cents went for expense.

SUMMARY OF DENTIST'S STATUS

Figures can be boring, but this is the picture: A group of men who earn what would correspond to a salary of a little more than $250 a month; who are private entrepreneurs (those who take the risk); whose earning life is comparatively

QUESTIONNAIRE

What Activity Should the Chicago Dental Society Engage in to Improve the Economic Conditions of Its Members?
278 cards used for tabulation
322 suggestions made

1.	Public education	121
	Publicity 93	
	Ethical advertising 14	
	School programs 7	
	Patient education 5	
	Dental Institute of America plan 2	
2.	Enforce ethics	30
	Eliminate advertisers 25	
	Dentistry by license only..... 5	
3.	Regulate fees	29
	Stabilize fees 11	
	Minimum fees 11	
	Raise prices 7	
4.	Establish credit bureaus	27
5.	Economic instruction	27
6.	Reduce supply prices	8
7.	Postgraduate instruction	7
8.	Oppose or support New Deal	6
9.	Oppose socialization	5
10.	Advocate health insurance; state medicine	4
11.	Support unions	5
12.	Increase requirements; limit number of dentists	5
13.	Oppose clinics and free school dentistry	5
14.	Establish collection system	4
15.	Limit working hours	4
16.	Reduce patient unemployment	4
17.	Revive industrial diagnostic service	2
18.	Miscellaneous answers	29
	Payment systems 5	
	Indefinite and vague..... 5	
	Make society membership advantageous 3	
	Old age benefits..... 2	
	Less society politics..... 2	
	Reduce dues 2	
	Laboratory problem 2	
	Compulsory dentistry 2	
	Establish legal service..... 2	
	Compete with industries..... 1	
	Study courses for assistants.. 1	
	Free examination for children 1	
	Continue relief service..... 1	
	Total	322

short; who have no benefits, such as Social Security protection, retirement and pension privileges, and no expectation of phenomenal increase in business; who have an educational investment of thousands of dollars; who have about $3,000 represented in equipment; who have occupational hazards, and who receive the first rebuffs of economic recession and the last rewards of recovery.

SUGGESTIONS FOR IMPROVEMENT

What do the dentists who responded to this questionnaire suggest in the way of remedies? What did they say ailed dental practice? What were their suggestions for improvement?

On almost every card that was acceptable for the study of the income distribution, there was some suggestion in answer to the question, "What activity should the Chicago Dental Society engage in to improve the economic condition of its members?" There were 278 cards used with 322 specific suggestions, shown in the accompanying table. By far the greatest number suggested public education by the Chicago Dental Society as the most important undertaking that the society could engage in, 121 dentists making this suggestion. Public education, of course, is a large and abstract suggestion. Ninety-three of the men believed that it should take the form of publicity, which, presumably, is an unpaid form of public enlightenment. Publicity, generally speaking, would include news stories, editorials and free broadcasting. Fourteen dentists want ethical advertising; that is to say, the purchase of newspaper space and of radio time to disseminate authorized information. Only seven thought that school programs had educational value, and five suggested patient education, which means, presumably, education in the dental office. Two mentioned the activities of the Dental Institute of America as the specific plan of their choice.

CONSIDERATION OF PUBLICITY VALUE

It would appear, then, that, according to the dentists, the chief deterrent to successful dental practice is lack of knowledge or appreciation on the part of the public. These men seem to be of the thought that merchandising technics are as applicable to stimulating dental practice as to stimulating a commercial enterprise. Publicity, or ethical advertising, is of no value unless definite efforts are made in the dental office to coordinate the presentation of dental service with the publicity activities. Specifically, what that means is this: Manufacturers of automobiles, radios, furniture, clothing and so on know that without personal selling, products cannot be distributed. The function of advertising is merely to create an interest and a demand. Advertising rarely results in a direct sale. The direct selling is done with as much vigor and as much planning as the advertising itself. In short, if publicity is to be used to encourage people to go to the dental office, dentists must be trained definitely and specifically in the proper presentation of services to the patient when he arrives in the dental office. The problem means a great deal more than merely getting a person into the dental chair. It is true that when the patient is in the dental chair, he has made two selections: He has selected the particular dentist whom he wishes to perform the service, and, out of the welter of other things that may be purchased, he has selected dentistry as one among his choices. By "choice," economic selection is meant. The patient, by voluntary action, decides that he will spend some of his dollars for dental service rather than for other forms of consumer's goods or services.

OPPORTUNITY IN THE DENTAL OFFICE

It is here that the dentist must be trained to present services in accordance with the intellectual levels of his patients. There can, of course, be no stock or

canned method of handling dental patients. There is no magic formula. It is trite to say merely that every dental patient presents a technical and clinical problem of his own: each presents a personality problem as well. In the patient-dentist relationship, there is a twofold function: to explain and describe clearly and adequately what the requirements of the case are and what the method of prescribed treatment should be, and to lay a groundwork in such a way as to prevent possible misunderstanding. Misunderstandings in human relationships are of many kinds. First, we must prepare ourselves to understand personalities totally unlike our own. Secondly, we must not promise too much, and if we must make promises at all, we should err on the side of promising too little. We must point out reasonable expectations and likely limitations; we should describe the possibilities in treatment, but advise the preferred treatment. Finally, money matters represent the source of many of the misunderstandings in the world. We must make plain to patients in the beginning of our relationship with them exactly what in money terms their obligations are, and how these obligations are to be met. To be sure, this does not mean placing a price tag on a dental service in blunt fashion. The problem must be dealt with definitely, but tactfully.

Material for mass appeal, presented for distribution either in print or over the radio, can do no more than promote a general interest in a subject. No one has ever been able to arrange words so effectively either in type or before a microphone as to drive people with enthusiasm into the dental office. If, by chance, they should come to a dental office because of something they have heard or read, it is necessary that we have ourselves so trained as to make the most of the opportunity in the person-to-person encounter in the dental office.

Advertising merely aids in arousing interest and creating potential demands. Although it may result in choice or selection, it cannot assure the final action of definite sales until the commodity or service is translated into terms of personal meaning. A professional service is entirely the fulfilment of a personalized, individualized, unstandardized need, which cannot be supplied or explained except in a person-to-person relationship. Advertising may arouse an interest in the general subject of dentistry; the dentist must translate the general interest into specific terms. There can never be any substitute for the person-to-person educational opportunity at the dental chair. It is a threadbare observation that dentists do not make the most of the opportunities that they now have. They do not tell the story of dentistry often enough or convincingly enough to the people that they now serve.

ENFORCEMENT OF CODE OF ETHICS

The next group of answers, thirty in number, suggested that the enforcement of the Code of Ethics was an extremely important factor in improving economic conditions. Twenty-five said that advertising dentists should be eliminated; whereas five said that dentistry should not be practiced except by license. We are all aware of the laudable efforts that the Chicago Dental Society has made in eliminating advertisers. I doubt whether any one can say that this job could have been done better in the face of the entrenched and strong opposition and organization presented by the advertising interests.

REGULATION OF FEES

Twenty-nine dentists said that the Chicago Dental Society should regulate fees. This, of course, suggests a planned economy wherein minimum fees and maximum hours would be prescribed. This attitude probably reflects the spirit of modern economics. The society can do nothing more than *suggest* fee schedules.

The minute a dental society organizes to *enforce* fee schedules by punitive action, it ceases to be a professional organization and becomes a trade union. A few men (exactly five) who answered this questionnaire did suggest that dentists should organize under the ideology of the trade union.

ESTABLISHMENT OF CREDIT BUREAU

Twenty-seven dentists suggested that a credit bureau should be established from which members of the Chicago Dental Society would receive information regarding the credit standing of the patients they serve. As is well known, professional credits are different from commercial credits; that is, there are people who will pay the butcher, the grocer and the baker, but who will not pay their professional obligations. Moreover, a credit bureau is of no value unless cooperating members are prepared to contribute information to the bureau in as full measure as they wish to receive information from it. They have to be just as anxious to send in credit reports about the patients that they are serving as to receive information concerning patients that they expect to serve. Most credit bureaus fail at this point. Dentists believe a credit bureau is something from which they can draw information, but not something to which they must supply information. A professional credit bureau covering a large metropolitan area, such as Chicago, would be a tremendous undertaking. In view of some of the experiences in local communities where it has not worked out successfully, there is the likelihood that it would not be a success.

ECONOMIC INSTRUCTION AND ENLIGHTENMENT

Another twenty-seven dentists thought that economic instruction was necessary. They believed that one of the major faults in the dental schools is that students are not trained in the realities of dental life and dental practice. I believe that their objection is valid in that dentists are turned out into the world with high-sounding phrases ringing in their ears, such as "The fee will take care of itself," and other banalities. Dental students should be taught their place in economic society; they should be trained to integrate themselves with society as a whole; they should be shown their economic advantages and disadvantages. To do less than that is to turn students into the world only partly prepared for reality. Seven dentists believed that postgraduate instruction in economics was necessary.

Six believed that the Chicago Dental Society should either support or oppose the New Deal. Five suggested that unions should be supported, and five, that the number of dentists should be limited; five more suggested that the dental society should oppose clinic and free school dentistry, and, curiously enough, five opposed socialization of dentistry, whereas four advocated socialization. The striking observation here, of course, is that, in the face of all the contemporary agitation for changes in the method of distribution of medical care, only nine dentists commented on this subject. This may be interpreted in several ways: that dentists are not interested in the subject; that they do not understand the threat of socialization, or that they are entirely unprepared for any change. Whatever the reason for their lack of comprehension of this subject, it represents negligence in their thinking. It means that many men in dentistry are or will be receptive to the clap-trap of false economists or that they will oppose blindly measures that might even be to their advantage. The dental society should certainly encourage original and earnest thinking on this major subject of dental economics. What is needed is information on the subject, not propaganda for or against. An enlightened group of dentists will have less to fear of the future.

The dental societies can encourage enlightenment by presenting programs and articles that are factual, not emotional.

MISCELLANEOUS SUGGESTIONS

Four dentists would like the Chicago Dental Society to establish collection agencies; four want hours of employment limited, which, like the comment on the regulation of fees, suggests an application of the principle of minimum wages and maximum hours.

Only four dentists in this study seem to grasp the significance that income in dental practice is closely intertwined with national income; that anything that will improve the economic life of the nation will improve dental practice. Only four dentists said that the way to improve the economic conditions of dentists was to reduce unemployment on the part of the public. To be sure, the dental society can do nothing about this.

Two dentists would like the Industrial Diagnostic Service to be revived. Twenty-nine gave miscellaneous answers, most of which were of so general a nature that they were of no value.

GENERAL SUMMARY

This whole body of response might be summarized in a few general statements:

1. Although the figures disclosed in this study, when coordinated with figures from national income, show that dental income rises and falls inexorably with national income, only a small number of dentists indicated this relationship. Dentists prosper when the country prospers and they suffer when the country suffers.

2. It appears that the expense of conducting a dental practice is about 40 per cent of the gross income.

3. Most of the dentists who answered the questionnaire believed that the technic of modern merchandising, either paid or free publicity, was a means of bringing economic improvement to dentists. Not one of these men suggested how this advertising was to be paid for, and not one apparently saw the grave danger that by adding the costs of advertising to the existing costs of dentistry, we could easily be plunging ourselves headlong into a situation in which all sorts of criticism would be directed against us by social reformers and legislators. It is a truism that bears constant repeating that the ultimate consumer always pays the cost of advertising.

4. Only seven dentists suggested that programs for the child had economic advantages; only seven dentists suggested that the Chicago Dental Society should engage in dental health programs in the schools. If we as a profession are so indifferent to the source of our supply of patients, it is a discouraging commentary on the level of our understanding.

5. There is an undercurrent that has not yet taken on the note of alarm. It would suggest that dentists are prepared for regulatory schemes as far as fees and hours are concerned. This means that the dental society, in the minds of some, should take on the characteristics of a trade union in which collective bargaining and solidarity of demand can be practiced; or, worse, that there is a group of men, both within and without dental organizations, who might be receptive to the overtures of trade unionists to organize unions among professional workers. Finally, it is possible that this group of men who are flirting with the idea of minimum fees and maximum hours might find promises of the state itself for salaried positions greatly to their liking.

6. Men who have met the trials of dental life know that they were unprepared for them. They recognize a gap in their dental training. They believe now that no dental course is complete without training in economics.

7. Finally, let us attempt to answer the question, "What is the status of dental practice in Chicago?" It is probably very much the same as it is elsewhere in the United States, no better and no worse. It

rises and falls with the great thermometer that indicates the nation's economic health. The average net dental income over the last five years would suggest that dentists make about $250 a month in Chicago. All around them, there are other people some of whom make more, many of whom make less. The people in industry, in business, are now being compelled to save for their old age and for periods of unemployment, for their social security. It is not unlikely that one day they will be compelled to save to meet the costs of illness, including dentistry.

INTERPRETATIVE COMMENT

Where does the dentist stand who, as private entrepreneur, has no protection against the indigencies of old age or unemployment except that which he may save from personal earnings? To be sure, he enjoys the intangible rewards of a kind of independence of action; he is not too scrupulously supervised by a government or by the regulations of a trade union. Private bargaining still has its place in his profession; he can give to the poor if he chooses, and occasionally he can benefit from the rich. But with the rich growing fewer and the pressure of taxation on the middle class growing greater, his sphere of activity, as far as economics is concerned, is constantly contracted. More and more people are finding it difficult to include health care in a budget.

This typical dentist in Chicago is apparently not ready to accept any changes in the system of dental practice. He wants it improved, but he still wants it to be private practice. In that, he is, of course, correct. But whatever form of change may come, he does not want the impersonal clinic to take the place of the private practice. If he were articulate, he would express, as he always has, his belief in free choice and in the maintenance of the personal relationship. He should, however, be prepared to suggest what can be done for the dental health of all the people at the same time that he suggests how the ideals that he values can be maintained.

America is made up of people at many levels of economic life. All these people require the services of dentists. We cannot afford to be heard saying that we are interested only in the dental life of the people at the highest level. The day that we are, we shall be classed as enemies of the people and be subject to their reprisals in the form of legislation.

The Chicago Dental Society has the opportunity, if it chooses to accept it, of formulating a dental plan for all the people which should improve their health and their lives as it improves the economic conditions of its individual members.

708 Church Street.

REFRESHER COURSE IN CHILDREN'S DENTISTRY

UNDER the auspices of the Michigan Department of Health, Postgraduate Division, University of Michigan, College of Dentistry, Michigan State Dental Society and local district dental society officers, a refresher course in children's dentistry will be given September 13, 20 and 27.

This course is made possible by funds from the Federal Social Security allotments of the Children's Bureau at Washington to the Bureau of Maternal and Child Health of the Michigan Department of Health. Classes will be held in the Hotel Olds, Lansing.

PROGRAM

Tuesday, September 13

Donald G. Bills, Lansing, President of the Central District Dental Society, presiding

C. W. Wilson, Detroit, special lecturer and clinician

(Dr. Wilson is a former director of the Children's Dentistry Section of the Detroit Dental Clinic Club, and special lecturer on this subject in postgraduate courses at the University of Michigan.)

10:00—"Management of Young Permanent Teeth; Care of Fractured Incisors"

Morning Session

11:00—Questions
11:30—Recess
12:00—Luncheon

Afternoon Session

1:30—"Cavity Preparation, Restorations and Filling Materials for Deciduous Teeth"
2:30—Questions
3:00—Clinic on actual cases illustrating lectures
4:00—Adjournment

Tuesday, September 20

M. J. Doyle, Lansing, vice-president of the Central District Dental Society, presiding

Kenneth A. Easlick, Ann Arbor, special lecturer and clinician

(Dr. Easlick is professor of children's dentistry in the College of Dentistry, University of Michigan.)

Morning Session

10:00—"The Preschool Child's First Appointment"
11:00—Questions
11:30—Recess
12:00—Luncheon

Afternoon Session

1:30—"Pulp Management for Deciduous and Young Permanent Teeth"
2:30—Questions
3:00—Clinic on actual cases illustrating lectures
4:00—Adjournment

Tuesday, September 27

O. Lee Ricker, chairman, Program Committee, Central District Dental Society, presiding

Walter C. McBride, Detroit, special lecturer and clinician

(Dr. McBride is professor of children's dentistry, University of Detroit, and special lecturer on this subject in postgraduate courses at the University of Michigan.)

Morning Session

10:00—"Office and Patient Management"
11:00—Questions
11:30—Recess
12:00—Luncheon

Afternoon Session

1:30—"Extractions, Anesthesia and Minor Oral Surgery"
2:30—Questions
3:00—Clinic on actual cases illustrating lectures
4:00—Adjournment

Most of the lectures will be illustrated by lantern slides and models. Matters of interest will be briefly presented by different speakers at the luncheons.

It is becoming more and more evident that education of the profession to deliver a better health service must go hand in hand with education of the public as to the value and desirability of such service. This is especially true in the matter of children's dentistry, which has been too much neglected on the average dental program, and yet today, when intelligently practiced, is one of the best practice builders for the profession, as well as the most economical for the patient in preventing later need for expensive restoration and possible health involvement.

Here is an opportunity for many dentists to get the most extensive course on this subject ever offered in Michigan outside the dental school.

There will be no fee for this course except for the three luncheons. Mark off the dates on your appointment book now and plan to attend every session. Lectures will start promptly at the hour scheduled.

AMERICAN DENTAL ASSOCIATION EIGHTIETH ANNUAL SESSION

ST. LOUIS, MISSOURI, OCTOBER 24, 25, 26, 27, 28, 1938

OFFICIAL CALL

To the Members of the American Dental Association:

You are hereby notified that the Eightieth Annual Session of the American Dental Association will be held in St. Louis, Mo., October 24-28, 1938.

The House of Delegates will convene at 10:00 a.m., Monday, October 24. The second meeting will be held at 2:30 p.m., Monday, October 24; the third meeting at 2:30 p.m., Wednesday, October 26, and the fourth meeting at 2:30 p.m., Thursday, October 27. The four meetings of the House of Delegates will be held in the Ballroom of the Hotel Statler. The Credentials Committee will register Delegates and Alternates, beginning at 10:00 a.m., Sunday, October 23, at the Hotel Statler.

All other members will register at the Registration Office in the Auditorium. The Registration Department will be open from 9:00 a.m. to 5:00 p.m., Sunday, October 23, and Monday, Tuesday, Wednesday, Thursday and Friday, October 24, 25, 26, 27 and 28.

The General Meeting which constitutes the opening exercises of the Session will be held Tuesday, October 25, at 9:30 a.m. The second and third General Meetings will be held on Tuesday and Thursday evenings, October 25 and 27, at 8:30 p.m. The three General Meetings will be held in the Opera House, Auditorium.

The constituent societies are notified to file with the Secretary of this Association at least thirty days prior to the first day of the Annual Session, a list of the names and addresses of their Delegates and Alternates.

C. WILLARD CAMALIER, *President.*
HARRY B. PINNEY, *Secretary.*

BOARD OF TRUSTEES OF THE AMERICAN DENTAL ASSOCIATION, 1937-1938

GENERAL PROGRAM

Registration (General) ..... Sunday, October 23, 9:00 a.m.
(Auditorium)

Registration (Delegates and Alternates) ..... Sunday, October 23, 10:00 a.m.
(Hotel Statler)

Board of Trustees (First Meeting) ..... Friday, October 21, 10:00 a.m.
(Hotel Statler)

Board of Trustees (Second Meeting) ..... Saturday, October 22, 10:00 a.m.
(Hotel Statler)

House of Delegates (First Meeting) ..... Monday, October 24, 10:00 a.m.
(Hotel Statler)

House of Delegates (Second Meeting) ..... Monday, October 24, 2:30 p.m.
(Hotel Statler)

House of Delegates (Third Meeting) ..... Wednesday, October 26, 2:30 p.m.
(Hotel Statler)

House of Delegates (Fourth Meeting) ..... Thursday, October 27, 2:30 p.m.
(Hotel Statler)

PRELIMINARY PROGRAM FOR ST. LOUIS SESSION

FIRST GENERAL MEETING

(Opera House, Auditorium)

TUESDAY, OCTOBER 25

Presiding officer, John S. Owens, First Vice President

9:30 a.m. Music
Richard Day, organist ..... St. Louis, Mo.

9:45 Invocation
Truman H. Douglass ..... St. Louis, Mo.

9:50 Greeting from the State of Missouri

10:00 Greeting from St. Louis
Mayor Bernard F. Dickmann ..... St. Louis, Mo.

10:05 Greeting from Dental Society of the State of Missouri
R. H. Miller, President ..... St. Louis, Mo.

10:10 Greeting from the St. Louis Dental Society
J. A. Jacobsmeyer, President ..... St. Louis, Mo.

10:15 Greeting from the Local Arrangements Committee
Oather A. Kelly, General Chairman ..... St. Louis, Mo.

10:20 Response of the American Dental Association

10:30 Introduction of visitors from foreign countries

10:35 Address of the President
C. Willard Camalier ..... Washington, D. C.

11:20 "Bone Infection"
E. Wilfred Fish ..... London, England

SECOND GENERAL MEETING

(Opera House, Auditorium)

TUESDAY, OCTOBER 25

Presiding officer, T. A. Hardgrove, Second Vice President

8:30 p.m. Music
Richard Day, organist.....St. Louis, Mo.

8:45 Address
National Dental Poster Awards

WEDNESDAY, OCTOBER 26

7:30 p.m. Dinner dance
In honor of the President, C. Willard Camalier
(Opera House, Auditorium)
Toastmaster, Lucien Brun.....Baltimore, Md.
Introduction of distinguished guests and brief remarks.

THIRD GENERAL MEETING

(Opera House, Auditorium)

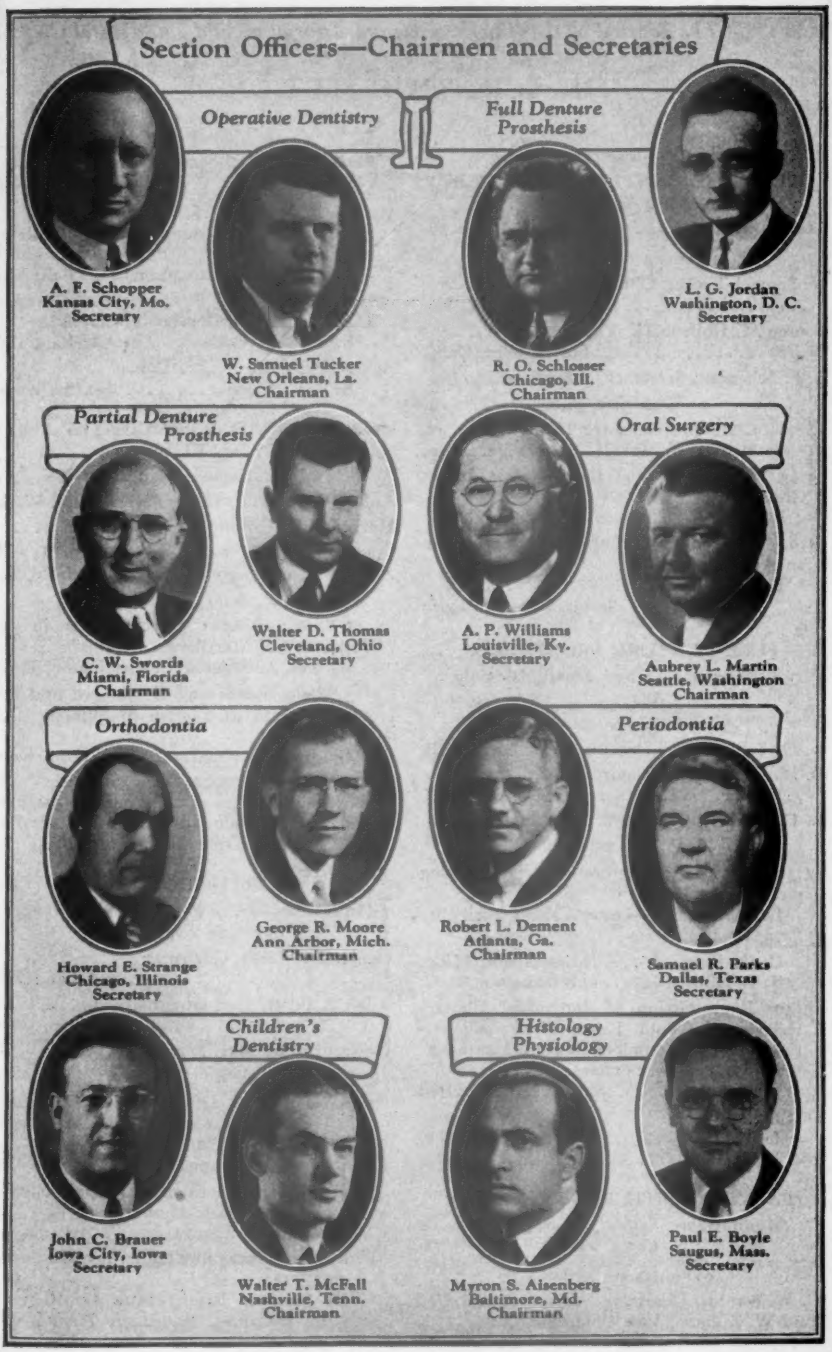
THURSDAY, OCTOBER 27

Presiding officer, Roscoe D. Cummins, Third Vice President

8:30 p.m. Music
Richard Day, organist.....St. Louis, Mo.

8:45 Introduction of speakers:
Floyd Hogeboom.....Los Angeles, Calif.
Symposium: Dental Health for American Youth
(Ten minute presentations)
"What Consideration Shall Be Given to Prenatal Care in Preparation for Good Teeth?"
Percy R. Howe.....Boston, Mass.
"What Procedures Can Be Instituted in the Infant and Preschool Life of the Child for Prevention and Control of Dental Caries?"
Russell W. Bunting.....Ann Arbor, Mich.
"What Procedures Should Be Followed for Early Detection and Correction of Defects in Deciduous and Permanent Teeth?"
George E. Morgan.....Milwaukee, Wis.
"What Suggestions Can Be Made for the Management of Children in the Dental Office?"
John E. Gurley.....San Francisco, Calif.
"What Suggestions Can Be Offered for Dental Hygiene in (a) the Dental Office; (b) the Schools; (c) the Home?"
Walter T. McFall.....Nashville, Tenn.
"What Is the Rôle of Deciduous Buccal Function in Preventive Orthodontics?"
R. C. Willett.....Peoria, Ill.
Town Hall Discussion
Conducted by Harry Allshouse, Jr.....Kansas City, Mo.
President, American Society of Orthodontists

Persons in the audience are invited to address the chairman on any question pertaining to the foregoing subjects. The question will be relayed to the speaker, and an attempt will be made to answer satisfactorily. It is hoped that this method of education will prove valuable to dentists and instructive to others who may be in attendance, and the audience is requested to cooperate heartily in making this an intelligent open forum.



CHAIRMEN AND SECRETARIES OF THE SCIENTIFIC SECTIONS OF THE AMERICAN DENTAL ASSOCIATION, 1938

UNIV. OF MICH.

THE SCIENTIFIC SECTIONS

TUESDAY, OCTOBER 25
OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Auditorium—Third Floor, Assembly Room 3)

OFFICERS OF SECTION

W. Samuel Tucker, Chairman.....New Orleans, La.
George M. Hollenback, Vice Chairman.....Los Angeles, Calif.
A. F. Schopper, Secretary...Kansas City, Mo.

2:30 to 5:00 p.m.

2:30 "Children's Dentistry That Pays"
By Walter T. McFall...Nashville, Tenn.

3:15 "Requirements of the Porcelain Jacket Crown"
By E. Bruce Clark.....Pittsburgh, Pa.

4:00 "A Modern Dental Health Service in an Ancient Land"
By Elias S. Khalifah.....Beirut, Lebanon, Syria

FULL DENTURE PROSTHESIS

(Auditorium—Second Floor, Assembly Room 1)

OFFICERS OF SECTION

R. O. Schlosser, Chairman.....Chicago, Ill.
O. M. Dresen, Vice Chairman.....Milwaukee, Wis.
L. G. Jordan, Secretary...Washington, D. C.

2:30 to 5:00 p.m.

2:30 "Immediate Denture Service" (Moving picture in color)
By Merrill G. Swenson...New York City
Discussed by
C. O. Flagstad.....Minneapolis, Minn.
S. S. Jaffe.....Washington, D. C.

3:40 "Reproduction of Individual Characteristics of Tooth Form, Color and Arrangement in Complete Denture Prosthesis"
By W. Les Warburton.....Salt Lake City, Utah
Discussed by
I. R. Hardy.....New York City
B. L. Hooper.....Lincoln, Nebr.

PARTIAL DENTURE PROSTHESIS

(Auditorium—Second Floor, Assembly Room 2)

OFFICERS OF SECTION

C. W. Swords, Chairman.....Miami, Fla.
Paul W. Zillman, Vice Chairman.....Buffalo, N. Y.
Walter D. Thomas, Secretary.....Cleveland, Ohio

2:30 to 5:00 p.m.

2:30 "Radiodontic Assistance in Replacement Problems"
By Clarence O. Simpson..St. Louis, Mo.

3:15 "Control of Resilient Stress-Bearing Tissue in Partial Denture Prosthesis"
By B. B. McCollum...Los Angeles, Calif.

4:00 "Porcelain Jacket Crown"
By J. E. Argue.....Seattle, Wash.

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Auditorium—Opera House)

Aubrey L. Martin, Chairman..Seattle, Wash.
Harry M. McFarland, Vice Chairman.....Kansas City, Mo.
A. P. Williams, Secretary.....Louisville, Ky.

2:30 to 5:00 p.m.

2:45 "Some Recent Developments in the Treatment of Maxillary Fractures"
By Roy A. Stout.....Washington, D. C.

3:15 "Pulp Stones and Devitalized and Impacted Teeth as Factors in Systemic Disease"
By J. W. Seybold.....Denver, Colo.

4:00 "Use of Rubber Bands in the Treatment of Fractures of the Bones of the Face and Jaws" (Followed by moving pictures)
By Reed C. Dingman.....Danville, Pa.

ORTHODONTIA

(Auditorium—Third Floor, Assembly Room 4)

OFFICERS OF SECTION

George R. Moore, Chairman.....Ann Arbor, Mich.
Allen E. Scott, Vice Chairman.....San Francisco, Calif.
Howard E. Strange, Secretary...Chicago, Ill.

2:30 to 5:00 p.m.

2:30 "Rate and Direction of Orthodontic Change and Effect on Distribution of Caries in Five Hundred Adolescents"
By J. A. Salzmann.....New York City

3:15 "General Practitioner's Responsibility in Prevention of Malocclusion"
By Frank F. Lamons.....Atlanta, Ga.

4:00 "Shall Faces Be Standardized in Orthodontic Treatment?"
By Caroline Risque Janis (Instructor in sculpture, St. Louis School of Fine Arts).....St. Louis, Mo.

PERIODONTIA

(Auditorium—Second Floor, Assembly Room B)

OFFICERS OF SECTION

Robert L. Dement, Chairman....Atlanta, Ga.
Dickson G. Bell, Vice Chairman.....
.....San Francisco, Calif.
Samuel R. Parks, Secretary.....Dallas, Texas

2:30 to 5:00 p.m.

2:30 "Electrocoagulation, Its Place in the Treatment of Periodontoclasia"
By Walter H. Scherer...Houston, Texas

3:15 "Diet as Related to Periodontal Conditions"
By Dorothea F. Radusch.....
.....Minneapolis, Minn.

4:00 "Traumatic Occlusion—Its Dental and Periodontal Effects, with a Means for Its Detection and Relief"
By John Oppie McCall...New York City

CHILDREN'S DENTISTRY AND ORAL HYGIENE

(Auditorium—Third Floor, Assembly Room B)

OFFICERS OF SECTION

Walter T. McFall, Chairman.Nashville, Tenn.
J. M. Wisan, Vice Chairman.Elizabeth, N. J.
John C. Brauer, Secretary...Iowa City, Iowa

2:30 to 5:00 p.m.

2:30 "Foundation Teeth: A New Name for the Deciduous Dentition"
By Joseph H. Kauffman..New York City

3:15 "Ectopic Eruption — Diagnosis and Treatment"
By Charles A. Sweet.....Oakland, Calif.

4:00 "Child Patient in a General Practice"
By Haidee Weeks.....New Orleans, La.

HISTOLOGY, PHYSIOLOGY, PATHOLOGY, BACTERIOLOGY AND CHEMISTRY (RESEARCH)

(Auditorium—Third Floor, Assembly Room A)

OFFICERS OF SECTION

Myron S. Aisenberg, Chairman.Baltimore, Md.
Don J. Aubertine, Vice Chairman.....
.....San Francisco, Calif.
Paul E. Boyle, Secretary.....Saugus, Mass.

2:30 to 5:00 p.m.

2:30 "Hormonal Therapy for Some Gingival Conditions"
By Daniel E. Ziskin.....New York City

3:15 "Bite Plates, Their Influence on the Growth of the Mandible"
By Samuel Hemley.....New York City

4:00 "Lessons from Field Studies Among Primitive Races"
By Weston A. Price.....Cleveland, Ohio

WEDNESDAY, OCTOBER 26

OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Auditorium—Third Floor, Assembly Room 3)

9:30 a.m. to 12:00 m.

9:30 "Radiodontia"
By James Coupland....Ottawa, Canada

10:15 "Local Anesthesia"
By Donald E. Woodard.....
.....Kansas City, Mo.

11:00 "Problems Involved in Reinforcing Under Porcelain"
By Fred R. Felcher.....Chicago, Ill.

FULL DENTURE PROSTHESIS

(Auditorium—Second Floor, Assembly Room 1)

9:30 a.m. to 12:00 m.

9:30 "Use of Intra-Oral Wax Records in Complete Denture Prosthesis (Illustrated with motion pictures)
By Walter H. Wright.....Pittsburgh, Pa.

Discussed by
C. J. Stansbery.....Seattle, Wash.
Fred S. Meyer.....Minneapolis, Minn.

10:40 "Analysis of the General Practitioners' Complete Denture Service"
By Robert N. Harper.....Danville, Va.

Discussed by
R. H. Kingery.....Ann Arbor, Mich.
G. W. Clapp.....New York City

PARTIAL DENTURE PROSTHESIS

(Auditorium—Second Floor, Assembly Room 2)

9:30 a.m. to 12:00 m.

9:30 "Bone Pathology in Partial Denture Prosthesis"
By John A. Marshall.....
.....San Francisco, Calif.

10:15 "Bone Changes from the Clinical and Roentgenographic Aspects"
By G. A. Hughes...San Francisco, Calif.

11:00 "Dietary Phase of Partial Denture Prosthesis"
By Nina Simmonds (Sc.D.).....
.....San Francisco, Calif.

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Auditorium—Opera House)

9:30 a.m. to 12:00 m.

9:30 "Oral Surgery"
By Vilray P. Blair (M.D.). St. Louis, Mo.

10:15 "General Anesthesia"
By K. C. McCarthy (M.D.).....
.....Toledo, Ohio

11:00 "Operative Radiodontia—A Plea for Better Roentgenography"
By Walter S. Thompson.....
.....Los Angeles, Calif.

ORTHODONTIA

(Auditorium—Third Floor, Assembly Room 4)

9:30 a.m. to 12:00 m.

9:30 "Timing Orthodontic Procedures"
By Stephen C. Hopkins.....
.....Washington, D. C.

10:15 "Observations of Children Between the Ages of Five and Twelve"
By Geneva E. Groth...Philadelphia, Pa.

11:00 "Orthodontic Problems Which Involve the Operative Dentist"
By Ira A. Lehman.....Detroit, Mich.

PERIODONTIA

(Auditorium—Second Floor, Assembly Room B)

9:30 a.m. to 12:00 m.

9:30 "Periodontoclasia—Importance of Early Diagnosis or Recognition"
By A. S. Hopkins.....Gulfport, Miss.

10:15 "Roentgen Rays in Periodontoclasia"
By George R. Warner.....Denver, Colo.

11:00 "Experiences in the Study and Treatment of Periodontal Conditions Over a Period of Forty Years"
By T. B. Hartzell....Minneapolis, Minn.

CHILDREN'S DENTISTRY AND ORAL HYGIENE

(Auditorium—Third Floor, Assembly Room B)

9:30 a.m. to 12:00 m.

9:30 "Health Education Courses for Dentists and Dental Hygienists"
By J. M. Wisan.....Elizabeth, N. J.

10:15 "The Place of Dental Hygiene in the Maternal and Child Health Program"
By Katherine Lenroot (Chief, Children's Bureau, U. S. Dept. of Labor)
.....Washington, D. C.

11:00 "Practical Economics in Children's Dentistry"
By John C. Brauer.....Iowa City, Iowa

HISTOLOGY, PHYSIOLOGY, PATHOLOGY, BACTERIOLOGY AND CHEMISTRY (RESEARCH)

(Auditorium—Third Floor, Assembly Room A)

9:30 a.m. to 12:00 m.

9:30 "Preservation of the Teeth by Control of Oral Bacteria"
By J. J. Moffitt.....Harrisburg, Pa.

10:15 "A Salivary Factor Which Determines Susceptibility or Resistance to Oral Growth of L. Acidophilus"
By T. J. Hill.....Cleveland, Ohio

11:00 "Physicochemical Studies of Enamel: The Organic Constituents of Enamel"
By Oscar Kanner (M.D.)...Chicago, Ill.

OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Auditorium—Third Floor, Assembly Room 3)

2:30 to 5:00 p.m.

2:30 "Modernized Fixed Bridge Construction" (Moving pictures)
By Herbert H. Kabnick..New York City

3:15 "Gold Foil" (Moving pictures in color)
By E. M. Jones.....Los Angeles, Calif.

FULL DENTURE PROSTHESIS

(Auditorium—Second Floor, Assembly Room 1)

2:30 to 5:00 p.m.

2:30 "Process for Combining Phenylic Resins with Vulcanite Bases in Complete Denture Construction"
By Thomas H. Kennedy...Dallas, Texas
Discussed by
G. P. Brenner.....Milwaukee, Wis.
J. I. Sloan.....Cleveland, Ohio

3:40 "Value of Anatomic Form in Teeth for Complete Dentures"
By Russell C. Wheeler....St. Louis, Mo.
Discussed by
M. J. Thompson.....Los Angeles, Calif.
V. H. Sears.....New York City

PARTIAL DENTURE PROSTHESIS

(Auditorium—Second Floor, Assembly Room 2)

2:30 to 5:00 p.m.

2:30 "Diagnosis in Closed Bite Conditions"
By H. L. Harris.....St. Paul, Minn.

3:15 "Correlation of Clinical and X-Ray Findings in Closed Bite Conditions"
By J. B. Costen (M.D.)...St. Louis, Mo.

4:00 "Restoring Normal Temporomandibular Relations"
By T. W. Maves.....Cleveland, Ohio

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Auditorium—Opera House)

2:30 to 5:00 p.m.

2:30 "Deep Neck Infection of Dental Origin"
By A. M. Alden (M.D.)..St. Louis, Mo.

3:10 "Ankylosis of the Jaw"
By M. N. Federspiel....Milwaukee, Wis.

4:00 "Surgical Treatment of Mandibular Deformities" (Followed by moving pictures)
By A. E. Smith.....Los Angeles, Calif.
James B. Johnson (M.D.).....
.....Los Angeles, Calif.

ORTHODONTIA

(Auditorium—Third Floor, Assembly Room 4)

2:30 to 5:00 p.m.

2:30 "Orthodontic Sense"
By Andrew Francis Jackson.....
.....Philadelphia, Pa.

3:15 "Art and Professional Life"
By E. H. Wuerpel (Director, St. Louis School of Fine Arts)....St. Louis, Mo.

PERIODONTIA

(Auditorium—Second Floor, Assembly Room B)

2:30 to 5:00 p.m.

2:30 "Vitamin A and B Deficiency as an Etiologic Factor in Acute, Subacute and Chronic Vincent's Infection; Polyavitaminosis: A Factor in the Etiology of Pyorrhea"
By J. A. Sinclair.....Asheville, N. C.

3:15 "Subgingival Curettage Treatment"
By Harold J. Leonard....New York City

4:00 "Periodontal Treatment by Surgical Flap Method, with Suggestions for Case Management"
By Olin Kirkland.....Montgomery, Ala.

CHILDREN'S DENTISTRY AND ORAL HYGIENE

(Auditorium—Third Floor, Assembly Room B)

2:30 to 5:00 p.m.

2:30 "Dentistry and Public Health"
By Charles F. Deatherage.....
.....Springfield, Ill.

3:15 "Ammoniacal Silver Nitrate as a Sterilizing Agent in Deep-Seated Decay in Deciduous Teeth"
By Ralph L. Ireland.....Lincoln, Nebr.

HISTOLOGY, PHYSIOLOGY, PATHOLOGY, BACTERIOLOGY AND CHEMISTRY (RESEARCH)

(Auditorium—Third Floor, Assembly Room A)

2:30 to 5:00 p.m.

2:30 "Topography of the Temporomandibular Joint"
By A. Petrilli (M.D.)...Rochester, N. Y.
J. E. Gurley....San Francisco, Calif.

3:15 "Significance of Early Dental Caries"
By E. E. Starr.....Portland, Ore.

4:00 "Recent Studies Concerning the Chemistry of Dental Caries"
By L. S. Fosdick.....Chicago, Ill.

THURSDAY, OCTOBER 27

OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Auditorium—Third Floor, Assembly Room 3)

9:30 a.m. to 12:00 m.

9:30 "Trifacial Neuralgia"
By Roland M. Klemme (M.D.).....
.....St. Louis, Mo.

10:15 "Our Patients Have the Right"
By Fred R. Adams.....New York City

11:00 "Pulp Protection in Restorative Dentistry"
By J. Roscoe Tipton.....Dallas, Texas
Business session and election of officers.

FULL DENTURE PROSTHESIS

(Auditorium—Second Floor, Assembly Room 1)

9:30 a.m. to 12:00 m.

9:30 "Registration of Centric Relation in Complete Denture Prosthesis"
By Homer Simpson.....Dallas, Texas
Discussed by
D. W. McLean.....Los Angeles, Calif.
W. H. Terrell.....Pasadena, Calif.

10:40 "Necessity and Value of a Definite and Thorough Course of Procedure in Full Denture Service"
By Herbert A. Munns.....
.....Minneapolis, Minn.
Discussed by
G. E. Tilton.....Wichita, Kan.
E. S. Smith.....Iowa City, Iowa
Business session and election of officers.

PARTIAL DENTURE PROSTHESIS

(Auditorium—Second Floor, Assembly Room 2)

9:30 a.m. to 12:00 m.

9:30 "Precision Removable Bridgework"
By Thomas P. Rose.....Chicago, Ill.

10:15 "Fixed Bridgework"
By Stanley D. Tylman.....Chicago, Ill.
Business session and election of officers.

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Auditorium—Opera House)

9:30 a.m. to 12:00 m.

9:30 "Diagnosis and Conservative Treatment of Common Oral Lesions Requiring Surgery"
By George J. Fink.....Boston, Mass.

11:00 "Physiologic Restoration of the Mandible by Oral Surgery and Prosthesis" (Followed by moving pictures)
By L. C. Turner.....San Antonio, Texas
W. Talbot Foster..San Antonio, Texas
Business session and election of officers.

ORTHODONTIA

(Auditorium—Third Floor, Assembly Room 4)

9:30 a.m. to 12:00 m.

9:30 "Joint Responsibility of the Dentist and the Orthodontist in the Care of Growing Children"
By Lowrie J. Porter.....New York City

10:15 "Present Status of Thumb and Finger Sucking"
By Leland R. Johnson.....Chicago, Ill.

11:00 "Technic of Facial Impressions and Casts; Its Application to Orthodontia"
By Arthur H. Bulbulian (M.D.).....
.....Rochester, Minn.
Business session and election of officers.

PERIODONTIA

(Auditorium—Second Floor, Assembly Room B)

9:30 a.m. to 12:00 m.

9:30 "Gingivectomy—Its Place in the Treatment of Periodontoclasia"
By E. L. Ball.....Cincinnati, Ohio

10:15 "Importance of Proper Home Care and Proper Follow-Up or Postoperative Care in the Treatment of Periodontoclasia"
By W. J. Charters.....Des Moines, Iowa

11:00 "Fads and Fancies in Periodontal Treatment That Have Passed into Disuse and Some Fundamentals for Successful Treatment That Remain"
By Rowe Smith.....Texarkana, Texas
Business session and election of officers.

CHILDREN'S DENTISTRY AND ORAL HYGIENE

(Auditorium—Third Floor, Assembly Room B)

9:30 a.m. to 12 m.

9:30 "Problems That Are Met in Teaching Children's Dentistry to Graduate and Undergraduate Dental Students"
By Kenneth A. Easlick.Ann Arbor, Mich.

10:15 "Public Health Aspects of the Dental Caries Problem"
By Frank C. Cady....Washington, D. C.

11:00 "Selling Children's Dentistry to the Public"
By Walter E. Briggs....Attleboro, Mass.
Business session and election of officers.

HISTOLOGY, PHYSIOLOGY, PATHOLOGY, BACTERIOLOGY AND CHEMISTRY (RESEARCH)

(Auditorium—Third Floor, Assembly Room A)

9:30 a.m. to 12:00 m.

9:30 Cooperative Research Program on Dental Materials at the National Bureau of Standards.
"The Research Commission's Program"
By P. C. Lowery.....Detroit, Mich.
"Colloidal Impression Materials and Base Metal Alloys"
By George C. Paffenbarger.....
.....Washington, D. C.
"Specification for Dental Hard Rubber"
By W. T. Sweeney (A.B.).....
.....Washington, D. C.
"Testing Certified Dental Materials"
By John R. Beall (B.S.).....
.....Washington, D. C.
H. J. Caul (B.S.)....Washington, D. C.
Business session and election of officers.
"Gnathodynamics"
By William P. Harrison.....
.....Los Angeles, Calif.

SCIENTIFIC SECTION

MOTION PICTURE PROGRAM

A complete motion picture program is planned by the General Arrangements Committee in collaboration with the Committee on Scientific and Health Exhibits.

A motion picture theater seating 250 will be available in the Auditorium four hours each day, two hours in the morning and two hours in the afternoon.

Pictures are being previewed by the Committee now and an interesting program will be posted each day of the meeting. Pictures that are especially popular will be reshown by request each day whenever time permits.

The motion picture program should be an interesting feature of the meeting, especially since the quality of motion pictures on dental subjects has been noted by the reviewing committee and commented on favorably by all who have been privileged to see them.

GENERAL CLINIC PROGRAM

THURSDAY AFTERNOON AND FRIDAY, OCTOBER 27-28

SECTION CLINICS

Operative Dentistry, Materia Medica and Therapeutics

"Trifacial Neuralgia"
Roland M. Klemme (M.D.).....
.....St. Louis, Mo.

"Local Anesthesia"
Donald E. Woodard...Kansas City, Mo.

"Problems Involved in Reinforcing Under Porcelain"
Fred R. Felcher.....Chicago, Ill.

"Modernized Fixed Bridge Construction" (Motion picture slides)
Herbert H. Kabnick.....New York City

Orthodontia

"Gnathostatic Interpretations in Orthodontic Diagnosis" (A three dimensional basis of diagnosis)
B. L. Herzberg.....Chicago, Ill.

"Construction of Anterior Plane Used in Deep Overbite, Molar Anchor Bands and Study Models, Using Rubber Cups"
Abraham Wolfson.....Newark, N. J.

"Chrome Alloy Soldering Technic"
Harry H. Sorrels..Oklahoma City, Okla.

"Orthodontic Record Keeping"
Floyd E. Gibbin.....Buffalo, N. Y.

"New Soldering and Polishing Technic for Stainless Steel"
Homer M. Shelden....Kansas City, Mo.

"Orthodontia"
Sherwood R. Steadman..St. Paul, Minn.

"Occipital Anchorage"
William B. Downs.....Aurora, Ill.

"Spherical Occlusion and Its Application in Orthodontic Treatment"
James W. Ford.....Chicago, Ill.

"Orthodontia"
Archie B. Brusse.....Denver, Colo.

"Orthodontia"
Harry B. Singler.....Springfield, Ill.

Periodontia

"Radiology in Diagnosis and Treatment of Periodontoclasia"
George R. Warner.....Denver, Colo.

"Toothbrush Technic"
W. J. Charters.....Des Moines, Iowa

"Roentgenographic and Photographic Evidence of Traumatic Occlusion"
John Oppie McCall.....New York City

INDIVIDUAL AND GROUP CLINICS

"Oral Surgery"
Paul H. Bennett.....Tucson, Ariz.

"All Porcelain Anterior Bridge with Standard Inlay Abutments" (Models and projection in color)
A. Laurence Dunn..Santa Barbara, Calif.

"Comparative Demonstrations of Correct and Incorrect Full Denture Form, Showing Facial Masks of Cases Taken Before and After Completion of Dentures"
R. E. Kinsman.....Beverly Hills, Calif.

"Full Coronal Restoration" (Taking the Impression, Making the Pattern and Controlling Expansion and Casting)"
James C. Campbell.San Fernando, Calif.

"Dental Hygiene in Long Beach Public Schools" (Display)
Robert E. Anderson..Long Beach, Calif.

"Normal and Abnormal in the Oral Cavity" (Colored slides)
Frank S. Kaiser.....Los Angeles, Calif.

"Homemade Instruments"
Walter C. Harbart...Los Angeles, Calif.

"Superimposing Technic in Roentgenography"
J. C. A. Harding.....San Diego, Calif.

"Oral Pathologic Specimen; Transilluminating Cabinet for Lantern Slides in Sequence"
Carl D. Lucas.....Los Angeles, Calif.

"Gold Foil"
J. C. Metcalf.....Alhambra, Calif.

"Reconstructive Plastic and Oral Surgery" (Exhibit)
Arthur E. Smith.....Los Angeles, Calif.

"Diagnosis of Force of Infection"
Chester H. Webber....San Diego, Calif.

"Precision Full Denture Technic for the General Practitioner"
Wilfrid H. Terrell.....Pasadena, Calif.
Roland Davis Fisher.....Glendale, Calif.

"New Approach in Pyorrhea Alveolaris"
William F. Lawrenz....Hollywood, Calif.

"Bone Stimulation as Applied to the Adaptation of Dentures"
E. J. Conley.....Pueblo, Colo.

"Closing Nasopalatine Opening by Flap Operation"
C. F. Brown.....Denver, Colo.

"A Method of Bleaching Discolored Pulpless Teeth"
W. H. Kirschner....New Haven, Conn.

"Oral Diagnosis"
Donald F. Lane.....Hartford, Conn.

"Dentistry One Hundred Years Ago"
S. James Krygier.....Dover, Del.

"Porcelain Veneer Crowns—Economy, Construction and Esthetics for Individual Restoration, and Bridge Abutments"
Willard F. Andes.....Miami, Fla.

"Lacing (Instead of Wiring) in Fractures of Mandible and Maxilla"
Robert F. Sullivan.....Savannah, Ga.

"Dentures; Using a Relationship Retainer"
R. G. Ioset.....Twin Falls, Idaho

"Esthetics in Full Denture Construction"
M. I. Trader.....Chicago, Ill.

"Surveying and Mounting of Cases When Increasing Vertical Dimension"
Paul A. Edmand.....Chicago, Ill.

"Complete Bridge Construction"
Harry Spiro.....Chicago, Ill.

"Immediate Denture Service"
Harry E. Denen.....Chicago, Ill.

"Partial Dentures"
Lester W. Boyd.....Chicago, Ill.

"Waxing of Cast Partial Dentures"
Otto L. Mast.....Chicago, Ill.

"Full Denture Construction"
L. E. Kurth.....Chicago, Ill.

G. V. Black Study Club of Des Moines, Iowa

"Preparation and Testing of Efficiency of Alkalinized Howe's Solution"
W. J. Cameron.....Des Moines, Iowa

"Microscopic Penetration"
F. W. Pillars.....Des Moines, Iowa

"Roentgenographic Disclosures"
F. F. Peel.....Des Moines, Iowa

"Accident and Abuse Corrections"
Gail T. Hoffman.....Des Moines, Iowa

"Prevention of Proximal Caries in Children's Teeth"
F. D. True.....Des Moines, Iowa

"Keeping the Teeth Dry; Application on Adult Teeth"
I. W. Foster.....Des Moines, Iowa
R. H. Killebrew.....Des Moines, Iowa
W. C. Darby.....Des Moines, Iowa

"Use of Solution in Deep Cavities and Pyorrhea"
F. E. Thornton...Valley Junction, Iowa

"Lower Impression Technic Applied to a Living Subject"
Sidney C. Fournet.....New Orleans, La.
Charles Shepard Tuller.New Orleans, La.

"Lower Partial Dentures Utilizing New Principles for Attaining Greater Stability"
William John Healey..New Orleans, La.

"Interesting Cases in Oral Surgery"
Joseph P. Wahl.....New Orleans, La.

"Cast Clasp Construction"
Prescott E. Smith.....New Orleans, La.

"Dental Health Service, a Method of Stressing Its Importance"
L. Lloyd Crites.....Boston, Mass.

"Extensive Porcelain Restoration and Bite Revision"
Harry Kazis.....Cambridge, Mass.

"Hollow Inlays"
Copeland Merrill.....Wellesley, Mass.

"Dental Health Service; Method of Stressing Its Importance"
O. L. Perrault.....Hudson, Mass.

"Clinical Methods Employed at the Fenway Dental Infirmary for Children, with Hints for the General Practitioner"
Fred H. Rogers.....Boston, Mass.

"Porcelain Inlays"
Hermann B. F. Seyfarth...Boston, Mass.

"Fixed Bridge Pontics, Using Tube Teeth and Preserving Esthetic Values; Movable Joint for Fixed Bridges When Abutment Teeth Are Tipped"
Lawrence Milton Staples..Boston, Mass.

"Method of Obtaining Balanced and Functional Occlusion in Full Mouth Reconstruction with Emphasis on Crown and Bridge Construction"
Fred S. Meyer.....Minneapolis, Minn.

"Dental Roentgenograms Selected"
Edward C. Stafne.....Rochester, Minn.

"Dental X-Ray Technic and Interpretation"
Louis R. Weiss.....Minneapolis, Minn.

"Protection of Cementation of Three-Quarter Crown by Application of Mechanics in Its Construction"
Walter E. Jones.....St. Paul, Minn.

Monson Research and Clinic Club, St. Paul, Minn.

"Full Mouth Fixed Reconstruction" (Movie film)
M. G. Walls.....St. Paul, Minn.
C. L. Miner.....St. Cloud, Minn.

"Muscle Trim Impressions with Plaster and Its Modifications"
C. M. Wells.....Canton, Miss.

"Surgical Preparation of Arch for Denture Conserving Cortical Layer of Bone"
A. H. Henderson.....Greenville, Miss.

Group Clinic

"Technic for Removing Difficult Teeth; Immediate Relief for Dry Socket"
Claude A. Moore.....Lexington, Miss.

"Removal of Fractured Roots with Replacement Instruments"
Fred D. Miller.....Altoona, Pa.

"Method of Infiltrating Upper Arch, Reducing Shock"
L. G. McGinnis.....Birmingham, Ala.

"Treatment of Pyorrhea and of Inflammation Around Third Molar"
John G. McConahy.....New Castle, Pa.

"Method of Adding 'Dentalone' to Cement Liquid in Sensitive Teeth"
N. H. Wallace.....Canton, Miss.

"Cavity Preparation in Amalgam Restorations"
Claude C. Cannon.....Fayette, Ala.

"Effect of Obstetrical Procedure on Maxilla and Dental Arches; Correction at Birth to a Predetermined Normality"
R. E. Ramaker.....Missoula, Mont.

"Gold Foil, Including All Phases of Operative Dentistry"
Herbert E. Williams....Red Bank, N. J.

"Amalgam Restorations"
John J. Cane.....Phillipsburg, N. J.

"Use of Investments for Making Porcelain Inlays"
Donald C. Padelford...Rochester, N. Y.

"Conservative Surgical Technic for Eradication of a Pyorrhea Pocket Under Topical Anesthesia"
Lillian Barkann.....New York City

"Gum Line Impressions for Inlays"
Daniel Jutton.....Syracuse, N. Y.

"Practical Suggestions on Children's Dentistry to Stabilize and Insure the Future Practice of the General Practitioner"
G. W. Patterson.....Batavia, N. Y.

"Approach of the Orthodontic Problem by the General Practitioner"
Meyer Hoffman.....Brooklyn, N. Y.

"Toothbrush Technic and Its Possible Value to Patient and Dentist"
David Schoen.....Baldwin, N. Y.

"Blood Cell Sedimentation Rate Test"
John B. West.....Elmira, N. Y.

"Modern Technic Employed in Pulp Canal Therapy"
Jacob B. Schneer.....New York City

"Full Dentures of Molded Porcelain"
Henry C. McBrair...Middletown, N. Y.

"Wire Clasp Making, Simplified"
Arthur S. Litten.....New York City

"Miniature Camera's Adaptability for Dental Use"
Percy Toumine Phillips...New York City

"Anterior Pinlays"
F. T. Wilcox.....Schenectady, N. Y.

"Demonstration of Histopathology of Periodontoclasia by Animated Models"
Edward R. Melcher.....Buffalo, N. Y.

"Immediate Dentures"
Amos G. Stiker.....Addison, N. Y.

"Complicated Orthodontic Cases"
Wright J. Burley.....Buffalo, N. Y.

"Oral Surgery—Pericoronal Infections and Sequelae Associated with Mandibular Third Molars"
Robert A. Robinson.....Albany, N. Y.

"Attachments for Modern Fixed Bridgework —Impressions by the Direct Method"
Simon Shapiro.....Brooklyn, N. Y.

"Orthodontia"
Harold M. Clapp.....Utica, N. Y.

"Preventive Dentistry"
Benedict S. Hert.....Rochester, N. Y.

"Miscellaneous Suggestions That Are Practical and Economical in Conducting Your Everyday Practice"
R. A. Wilkins.....Burlington, N. C.

"Anatomic Dissection of Head and Neck"
K. L. Johnson.....Raleigh, N. C.

"Elimination of Periodontal Pockets"
Dan B. Mizell.....Charlotte, N. C.

"Inlay Aids"
Z. Vance Kendrick, Jr...Charlotte, N. C.

"Various Types of Impactions and Difficult Extractions" (Illustrated by wax and soap models)
Adolph L. Bielski.....Pittsburgh, Pa.

"Slice Cavity Preparation for Cast Gold Inlays"
C. S. Harkins.....Osceola Mills, Pa.

"Magnifying X-Ray Viewer That Any Dentist Can Make"
J. S. Frost.....Crafton, Pa.

"X-Rays in Operative Dentistry" (Illustrated with slides)
C. R. Fricke.....Etna, Pa.

"Hydrocolloid Impressions for Inlays and Bridges"
Walter T. Newton.....Houston, Texas

"Practical Surgery for the General Practitioner"
Waldo Beckley.....Borger, Texas

"Porcelain"
T. V. Conner.....Dallas, Texas

"Reproduction of Individual Characteristics of Tooth Form, Color and Arrangement in Complete Denture Prosthesis"
W. Les Warburton..Salt Lake City, Utah

"Operative Considerations in Restoring Cuspid Teeth Which Are to Receive Partial Denture Cast Clasps"
A. Hubert.....Richmond, Va.

"Gold Inlays by the Direct Method"
Ray G. Perschbacher...Milwaukee, Wis.

"Porcelain Inlay Technic Without Use of Platinum Matrix"
H. M. Uebele.....Milwaukee, Wis.

"Problem of the Mesioclusodistal Inlay in Bridgework"
O. G. Krause.....Milwaukee, Wis.

"Fixed Movable Bridgework"
A. H. Bassman.....Milwaukee, Wis.

"Use of the Bonwill-Hawley Chart as Aid in Predetermining Ideal Typal Arch Form"
Leonard P. Wahl.....Wausau, Wis.

"Exodontia Simplified for the General Practitioner"
Harry E. Lando.....Milwaukee, Wis.

"Chrome-Alloy (Stainless Steel) in Orthodontics—Special Soldering Technic; Electric Spot Welding Technic"
J. B. Franklin.....Milwaukee, Wis.

"Definite Cavity Preparation for Gold Inlays in Anterior Teeth; Modified Lingual Step"
Grant W. Newby.....Platteville, Wis.

"Functional Occlusion Under Control"
George P. Brenner.....Milwaukee, Wis.

American Dental Assistants Association

Alabama:

"Cements"
Alabama Dental Assistants Association

California:

"Materia Medica"
Alameda County Dental Assistants Association

"Developing and Care of X-Ray Films"
Alameda County Dental Assistants Association

"Chair Assistance"
Los Angeles Dental Assistants Association

"Care of the Child Patient"
Sacramento Dental Assistants Association

"Introducing the Child to Dentistry"
San Francisco Dental Assistants Association

Georgia:

"Knowledge of Burs"
Georgia Dental Assistants Association

Illinois:

"Helpful Hints"
Chicago Dental Assistants Association

Indiana:

"Child Management"
Indiana State Dental Assistants Association

"Denture Patient Psychology"
Indiana State Dental Assistants Association

Massachusetts:

"Assistance for the Assistant"
Massachusetts Dental Assistants Association

"Various Applications of the Casting Art in General Practice"
Massachusetts Dental Assistants Association

Missouri:

"Copper Electroplating Dies"
Kansas City Dental Assistants and Hygienists Society

Nebraska:

"Interesting the Child Patient"
Nebraska Dental Assistants Association

"An Aid in X-Ray Filing"
Nebraska Dental Assistants Association

New Jersey:

"Toothbrush Drill"
New Jersey State Dental Assistants Association

Ohio:

"Office Linens and Patient Comforts"
Cincinnati Dental Assistants Association

"Tooth Carving"
Columbus Dental Assistants Association

"Which Is Your Assistant?"
Dayton Dental Assistants Association

Pennsylvania:

"Packing of Amalgam Dies"
Philadelphia Association of Dental Nurses

"Mixing Amalgam"
Pittsburgh Dental Assistants Association

American Dental Hygienists' Association

Florida:

"Progress in Dental Hygiene"
Florida Dental Hygienists Association
Catherine Mooney
Ijourie Stocks
Pearl Buffum
Celia Perry, *Chairman*

District of Columbia:

"Weeping Willie and Smiling Sam"
District of Columbia Dental Hygienists Association
Sophie Gurevich

Massachusetts:

"Sterile Technic"
Massachusetts Dental Hygienists Association
Edna Haliburton
Ann Wiltshire
Lillian Landry

Wisconsin:

"Dental Hygienist as Dentist's Practice Builder"
Wisconsin Dental Hygienists Association
Mary Mikalonis

MIDWEST DAY CLINICS

"Control of Caries in Children's Teeth"
V. H. Laager.....Webster Groves, Mo.

"Removable Bridgework: Steps to Finished Case; Different Clasps; Causes of Faulty Bridgework"
Charles P. Grosby.....St. Louis, Mo.

"Using Jaw Relator for Securing and Retaining Vertical Dimension, Centric, Protrusive and Right and Left Lateral Jaw Relations"
Edward Henry Eden.....St. Louis, Mo.

"New Type of Pulp Tester"
Paul C. Langenbach.....St. Louis, Mo.

"Cast Aluminum Alloy Saddles and Bars for Partial Dentures"
John F. Jonas.....St. Louis, Mo.

"Cutting Through Contact Points on Proximal Surfaces"
Lawrence E. Granstaff....St. Louis, Mo.

"Prophylaxis"
Walter H. Heseman....Washington, Mo.

"Full Upper and Lower Denture Construction"
William P. Katz.....St. Louis, Mo.

"Problems and Technic in Local Anesthesia, Exodontia and Oral Surgery"
Keith L. Buechele.....St. Louis, Mo.

"Baked Porcelain Crowns"
David W. Brock.....St. Louis, Mo.

"Rizadontia: The Foundation of Conservative Dentistry"
J. A. Walther.....St. Louis, Mo.

"Operative Dentistry"
E. A. Hotfelder.....St. Louis, Mo.

"Periodontoclasia"
James M. Gray.....St. Louis, Mo.

"Exodontia"
F. J. Brockman.....St. Louis, Mo.

"What Can Be Done with Abscessed Teeth?"
Richard G. Sendke.....St. Louis, Mo.

"Use of Copper Alloy in Combination with Silver Alloy"
Edgar M. Carson.....St. Louis, Mo.

"Pin Inlays"
Waldo H. Ehlers.....St. Louis, Mo.

"Fracture Proof Interchangeable Facing for Close, Irregular or Heavy Bites"
John B. Robinson.....Farmington, Mo.

"Necessity for Treatment of Malocclusion by the General Practitioner in Rural Communities"
L. J. Huber.....Genevieve, Mo.

"Three-Quarter Crown Technic"
C. W. McGee.....Webster Groves, Mo.

"Anomalies of Third Molar"
F. G. Bickel.....St. Louis, Mo.

"Exhibit of Anatomic Abnormalities"
A. J. Padberg.....St. Louis, Mo.

"Reproduction Impression Material"
T. A. Monch.....St. Louis, Mo.

"New Type Slot Facing"
R. Gilmore.....St. Louis, Mo.

"Cervical Gold Inlay; Cavity Preparation and Wax Manipulation"
R. S. Whiteaker....Webster Groves, Mo.

"Interesting X-Ray Films"
P. M. Westfall.....Creve Coeur, Mo.

"Small Defects That Can Be Found in Roentgenograms"
V. P. Thompson....Webster Groves, Mo.

"Upper Impression Technic"
P. J. Kaullen.....St. Louis, Mo.

"Amalgam Technic"
L. J. Hodapp.....St. Louis, Mo.

"Fixed Movable Sanitary Bridges"
Joseph L. Necker.....St. Louis, Mo.

"Dental X-Ray Projector as Camera and Enlarger"
Ralph Rosen.....St. Louis, Mo.

"Diagnosis and Treatment of Periodontoclasia"
Thomas E. Prosser...East St. Louis, Ill.

"Retainer"
R. W. Leavitt.....Steelville, Mo.

"Bridge Abutments"
J. J. Styblo.....St. Louis, Mo.

"Types of Mandibular Ridges with Suitable Technic for Each"
E. B. Owen.....St. Louis, Mo.
J. W. Templeton.....St. Louis, Mo.

"Identical Malocclusion in Identical Twins"
Arlo M. Dunn.....Omaha, Nebr.

"Replacing Any Anterior Tooth by Anchoring to Adjoining Tooth"
J. A. Wells.....Shawnee, Okla.

"Coordination of Surgical and Orthodontic Treatment in Cleft Lip and Palate Deformities"
Frank P. Bertram..Oklahoma City, Okla.

"Impressions for Inlays and Bridges Using a Hydrocolloid Material Under Pressure"
Watt A. Biggs.....Evansville, Ind.

"Full Dentures"
L. F. Smith.....Indianapolis, Ind.

"A Crippled Child"
T. M. Robertson.....Coffeyville, Kan.

"Casting Gold Inlays"
Fred G. White.....Fort Smith, Ark.

"Orthodontia for the General Practitioner"
John N. Katrana.....East Moline, Ill.

"Treatments for Abscessed Teeth or Putrescent Deciduous Teeth"
Roy C. Kolb.....Mascoutah, Ill.

"Rebasing Full Upper Denture"
W. A. Alexander.....Carlinville, Ill.

"Six Cardinal Points for the General Practitioner in Removal of All Teeth; Technic for Sutureless Flap in Single Extractions"
George Schneider.....LaSalle, Ill.

"Roofless Denture Impression Technic"
William Blickenstaff....Monticello, Ind.

"Bandless, All-Wire Removable, Regulating Retaining Appliance; Chin Retractor"
W. E. Stoft.....Omaha, Nebr.

"Explaining to Patients Advantages of Corrected Occlusion, with Models"
Edward Jacob.....Gary, Ind.

"Root Canal Surgery"
T. A. Leach.....Hutchinson, Kan.

"Periodontia—Results of Oxygen Treatment"
Herbert T. Holdren.....Salina, Kan.

"Dental Health Education"
A. L. Bomer.....Poplar Bluff, Mo.

"Porcelain Jackets and Porcelain Bridges"
A. F. Zacher.....St. Louis, Mo.

"Foiling Dentures Mechanically"
Paul A. Ebeling.....St. Louis, Mo.

"Establishing and Maintaining Own Reference File"
Herbert A. Kuntz.....St. Louis, Mo.

"Unusual Teeth"
Edwin R. Wagner.....St. Louis, Mo.

"Sandpaper Disk Mandrel"
Charles W. Gilliland.....St. Louis, Mo.

"Lower Fixed Bridge Showing Less Gold on Occlusal Aspect"
Thomas J. Gleason.....St. Louis, Mo.

"Making and Using Vulcanite Models"
J. Lester Wood.....St. Louis, Mo.

"Extraction Aids for the General Practitioner"
E. M. Conner.....St. Louis, Mo.

"Split Tray Impression Technic for Immediate Lower Denture"
Irwin B. Dunhaupt.....St. Louis, Mo.

"Correction of Single Malposed Tooth with Gold and Porcelain"
Willard James Scott.....St. Louis, Mo.

"Technic and Armamentarium for Extraction of Teeth"
Carl E. Ellis.....Nashville, Tenn.

"One-Piece Cast Fixed Bridgework"
William B. Cockroft....Memphis, Tenn.
Herman C. Levitch.....Memphis, Tenn.

"Baked Joint Detached Post Porcelain Crown"
J. Guilford Sharp.....Knoxville, Tenn.

"Local Anesthesia"
E. H. Krekeler.....Gillespie, Ill.

"Postextraction Splints"
J. Donald McPike.....Muscatine, Iowa

"Use of Impactor in General Practice"
M. H. Kelley.....Knox, Ind.

"Ultramodern Dental Porcelain Restorations"
Robert K. George.....Indianapolis, Ind.

"Method of Obtaining Facial Length, Centric Relation and Balanced Articulation"
John H. Yates.....Indianapolis, Ind.

"Methods Used During Twenty Years of Immediate Denture Construction"
Charles Albert Priest.....Marion, Ind.

"Inexpensive Substitute for Gold in Simple Restorations"
S. L. Benson.....St. Louis, Mo.

"Mat Gold, Gold Foil; Where Indicated; Qualities as Filling Material and How to Apply Them"
T. H. Granger.....Ada, Okla.

"Gold Restorations and Original Bridge Abutments"
Garnett Austin.....Chattanooga, Tenn.

"A Mouth-Prop Inhaler for Analgesia and Anesthesia"
John J. Ogden.....Memphis, Tenn.

"Rebuilt Mouths with Roentgenograms Before, During and After Reconstruction"
T. E. Braly.....Chattanooga, Tenn.

"Original Three-Quarter Crown Direct Wax Impression Technic"
J. R. Griebler.....Meredosia, Ill.

"Orthodontics in General Practice"
A. W. Brandhorst.....Alton, Ill.

"Dentigerous Cyst"
H. A. Brethauer.....Belleville, Ill.

"Method of Securing Centric Relation and Transferring to the Articulator"
J. C. Higgason.....Danville, Ill.

"Ornamental Castings in Precious Metal as a Hobby"
Benjamin M. Vogel.....St. Louis, Mo.

"Stimulative Toothbrushing Method"
J. Albert Jacobsmeyer....St. Louis, Mo.

"Increasing Efficiency of Lower Dentures"
Charles S. Helm.....Rockford, Ill.

"Fixation of Mandibular Fractures"
Clarence R. Benney.....Fort Riley, Kan.
Jack M. Hawkins.....Fort Riley, Kan.

"Orthodontic Treatment in Anterior Occlusion Showing Progress Made in Case"
John W. Richmond...Kansas City, Kan.

"Denture Reproduction"
Arthur H. Jones.....St. Louis, Mo.
Edward J. Keith.....St. Louis, Mo.

"Cases Treated for Temporomandibular Joint Syndrome"
Harry M. Klenda.....Wichita, Kan.

"Gold Castings and Porcelain"
Earl J. Poe.....St. Louis, Mo.

Woodbury Study Club
C. E. Woodbury, Director.....
.....Council Bluffs, Iowa

"Class One Cavities"
J. G. Colgan.....McCook, Nebr.
C. M. Stebner.....Laramie, Wyo.
G. L. Spencer.....Lincoln, Nebr.
F. W. Albrecht.....Lincoln, Nebr.

"Class Two Cavities"
W. L. Kling.....Wahoo, Nebr.
E. J. LaPorte.....Omaha, Nebr.
H. A. Merchant.....Omaha, Nebr.
M. E. Reinking.....Sioux City, Iowa

"Class Three Cavities"
J. H. Davis.....Sioux City, Iowa
I. S. Oakland.....Vermillion, S. D.
W. F. Hemphill.....Blair, Nebr.
James W. Kapp.....St. Joseph, Mo.
W. H. Kenderdine.....Dickens, Iowa

"Class Five Cavities"
I. S. Hasek.....Sioux City, Iowa
C. H. Stewart.....Farragut, Iowa
L. E. Myers.....Omaha, Nebr.
F. W. Schaefer.....Omaha, Nebr.
R. G. Drake.....Omaha, Nebr.
H. D. Coy.....Shenandoah, Iowa

"Table Clinics"
H. G. Bolks.....Sioux City, Iowa
H. W. Sidwell.....Villisca, Iowa

"Lower Impression Wax and Compound Requiring One Vulcanization"
Carl T. Ostrem.....Des Moines, Iowa
F. A. Barnes.....Ames, Iowa

"Stability in Lower Dentures"
W. E. Nolting.....Elmwood, Ill.

"Amalgam Restorations"
A. L. Butler.....Lewisville, Ark.

"Lower Technic"
Hugh C. Hayden.....Hammond, Ind.

"Periodontia"
W. M. Slack.....Memphis, Tenn.

"Crystallographic Dental Anatomy Versus Present Dental Anatomy"
Howell Boatner.....Springfield, Mo.

"Reenforced Shoulderless Porcelain Jacket Crown"
A. O. Klaffenbach.....Iowa City, Iowa

"Gold and Platinum Foil Fillings with Pneumatic Condenser"
George C. Alsbach.....Ada, Okla.

"Preserving Carious Teeth with Howe's Ammoniacal Silver Nitrate"
Charles E. Baker.....David City, Nebr.

"Immediate Replacement of Fractured Teeth on Artificial Dentures"
R. Frank Denny.....Indianapolis, Ind.

"Fixed Bridge Technic"
W. B. Dorman.....Camden, Ark.

"Dry Socket—A Dressing That Controls Pain and Promotes Healing"
W. T. Rutledge.....Monroe City, Mo.

"Groove and Wall Checker for Paralleling Bridge Abutments; Method for Mounting Cases on Simplex Articulator"
L. S. Bunch.....Cape Girardeau, Mo.

"Inlay and Bridge Indicated in Malocclusion from Loss of First Permanent Molar"
O. C. Hancock.....St. Louis, Mo.

"Abnormalities"
F. Ralph Moore.....St. Louis, Mo.

"Partial Dentures"
E. C. Brooks.....St. Louis, Mo.

"Reinforcement of Alloy in Shifting of Teeth"
N. A. Slane.....St. Louis, Mo.

"Mounting Base Plates and Dentures on Simplex Articulator"
C. A. Noland.....Monroe City, Mo.

"Mirror Eyes Versus X-Ray Eyes"
W. P. Rumpeltes.....Beatrice, Nebr.

"Nitrous Oxide: Preparation for General Anesthetic"
R. J. Miller.....Seymour, Ind.

"Baked Porcelain Inlays"
J. B. Carr.....Indianapolis, Ind.

"Removable Bridge Attachments for Anterior Teeth"
E. E. Welch.....Topeka, Kan.

"Detail Technic for Alloy Restorations"
Walter J. Wyrick.....Texarkana, Ark.

"Indirect Method of Inlay Construction"
Kenneth R. Pfeiffer.....Louisville, Ky.

"Simple, Important Procedure To Be Followed in Every Extraction"
Harry E. Loving.....Bristol, Tenn.

"Synthetic Porcelain Restoration of Incisal Angles, Using Pin-Lock Inlay and Modifications"
Ben Dent.....Memphis, Tenn.

"Reconstruction of Facial Contour by Means of Prosthetic Restorations"
John Frank Helmsen.....St. Louis, Mo.

"Simple Method of Obtaining Correct Bite"
Edmund L. Griffith.....Freeport, Ill.

"Control of Hemorrhage with Monsel's Solution"
C. J. Montgomery.....Charleston, Ill.

"Roofless Denture Fundamentals in Denture Construction"
Walter E. Beyer.....Indianapolis, Ind.

"Steps in the Preparation of Gold Inlays"
Edward J. Berens.....Hammond, Ind.

"Facial Mask in Dentistry"
Joseph R. Bustetter.....Louisville, Ky.

Tulsa (Okla.) Group Clinic

"New Method of Taking Full and Partial Denture Impressions"
John A. Wadlin
W. D. Rush
G. A. Roelke
O. F. Sinks
Opal Callihan
Josephine Staley

Kansas City-Western Dental College

"Diagnostic Factors in Complete Denture Construction"
Roy L. Felkner.....Kansas City, Mo.

"Deformities of Mouth Calling for Surgical Correction"
Morven T. Curran....Kansas City, Mo.

"Relative Merits of Various Impression Materials for Complete Dentures"
Chastain G. Porter.....Kansas City, Mo.

"Establishing Correct Maxillomandibular Relation"
Dayton Dunbar Campbell.....
.....Kansas City, Mo.

"Esthetic Factors in Arrangement of Teeth"
John V. Brown.....Kansas City, Mo.

"Mechanical Factors in Arrangement of Teeth"
F. Hubert Eversull....Kansas City, Mo.

"Relative Merits of Denture Base Materials"
E. L. Dillon.....Kansas City, Mo.

"Treatment and Filling of Root Canals"
Carl W. Sawyer.....Kansas City, Mo.

"X-Ray Interpretations of Chronic Osteomyelitis"
Claude W. O'Dell.....Kansas City, Mo.

"Partial Dentures"
Leonard E. Carr.....Kansas City, Mo.

"Oral Surgery"
Ralph W. Edwards....Kansas City, Mo.

"Some Innovations in Semi-Indirect Inlay Technic"
Hugh M. Tarpley.....Quincy, Ill.

"Helpful Hints for General Practitioner"
Donald M. Butler.....Sullivan, Ill.

"Selecting Teeth for Complete Restorations"
Earl L. Richey.....Rockford, Ill.

"Full Dentures"
DeW. H. Milstead....East St. Louis, Ill.

"The 0.016 and 0.020 Labial Arch"
J. Victor Benton.....Wichita, Kan.
J. M. Jones.....Wichita, Kan.

"Interesting Cases in General Practice"
Benjamin F. Zellinger.....St. Louis, Mo.

"Suggestions for Toothbrushing Applicable to Most Cases"
C. M. Smith.....Peoria, Ill.

"Reducing Fractures of Mandible"
L. E. Lawson.....Williamson, W. Va.

"Cast Restorations and Fixed Bridgework"
J. D. Hart.....Wewoka, Okla.

"Models as a Means of Convincing Patient of Need for Partial Dentures"
John P. Curd.....Louisville, Ky.

"Jaw Fractures"
Paul A. Risk.....Lafayette, Ind.

"Clearer Dental Roentgenograms"
Glen B. Ross.....Michigan City, Ind.

"Clinical Research in Amalgam"
Joseph R. Jarabak..Indiana Harbor, Ind.

"Brains Versus Bands in Orthodontia"
Blaine Truesdell.....Omaha, Nebr.

"Cast Gold Partial Denture by Indirect Method. Demonstration of Salient Steps of Procedure"
Lester Burstone.....St. Louis, Mo.

"Fixed Bridgework"
W. W. Brown.....Joplin, Mo.

"Full and Partial Gold Crowns"
Ray V. Smith.....Iowa City, Iowa

"Stable Lower Denture"
W. T. Jacobs.....Muskogee, Okla.

"Silicate Porcelain Fillings"
H. C. Lumpp.....Mattoon, Ill.

"Bite Wing Roentgenograms"
J. Bernard Poindexter.....Huntington, W. Va.

"Constructing Bridgework in Coordination with Dentures"
Lee H. Johnston.....Kansas City, Mo.

"Roofless Dentures"
G. L. Wood.....Geneseo, Ill.
M. M. Everett.....Geneseo, Ill.

"Dental Economics—How the Dental Dollar Is Spent"
M. M. Lumbattis.....Mt. Vernon, Ill.

"Cast Aluminum Base Dentures"
George M. Livesay.....Elgin, Ill.

"Treatment of Dry Sockets"
C. H. Grandstaff.....Rockford, Ill.

"Impression Technic"
E. M. Bush.....Rossville, Ill.

"Extra-Oral Roentgenograms of Cyst, Fractures and Unerupted Teeth"
Fred Morrison.....Kokomo, Ind.

"Improved Nasal Inhaler for Nitrous Oxide"
A. R. Transue.....Overton, Nebr.

"Alloy Veneers for Protecting Cupped Out Dentin"
H. W. McMillan.....Roseville, Ill.

"Gold Inlays in Porcelain Teeth"
T. H. Daly.....Mt. Carmel, Ill.

"Maintaining Accuracy of Occlusion in Opening the Bite"
J. Frank Blakemore.....Fort Smith, Ark.

"All Porcelain Dentures"
Charles A. Furrow.....Tulsa, Okla.

"Making Amalgam Dies"
Mary C. Turgi.....South Bend, Ind.

"Method for Securely Retaining Attachments to Abutments in Fixed Bridgework; Reproduction of Practical Cases"
L. E. Trinkle.....Terre Haute, Ind.

"Painless Devitalization of Deciduous Teeth; Treatment for Preservation of Putrescent Deciduous Molars"
W. R. Rodenhouser.....Peoria, Ill.

"Conversations with Mothers About Children's Teeth"
Harry B. Shafer.....Anna, Ill.

"Practical Suggestions for Properly Functioning Dentures"
H. L. Freidinger.....Decatur, Ill.
H. S. Alsip.....Decatur, Ill.

"Silver Amalgams"
E. E. Ramsey.....Topeka, Kan.

"Spot Welding"
Cecil G. Muller.....Omaha, Nebr.

"Practical Pulp Protection"
J. Emmett Northcutt...Kansas City, Mo.

"Lichen Planus"
E. V. Lambrechts.....St. Louis, Mo.

"Immediate Dentures"
C. B. Ball.....Frederick, Okla.

"Hydrocolloid Impression Technic"
Lloyd H. Dodd.....Decatur, Ill.

"Intra-Oral Photography"
J. S. Voyles.....St. Louis, Mo.

"Root Canal Fillings"
R. W. Osterkamp.....St. Louis, Mo.

"Crown and Bridge Work"
Lloyd B. Wright.....St. Louis, Mo.

"Cast Gold Removable Bridge; Design, Waxing and Casting"
Frank E. Diekneite.....St. Louis, Mo.

"Preoperative and Postoperative Procedures"
E. F. Hartwig.....St. Louis, Mo.

"Types of Castings for Fixed Bridge Abutments"
Fred E. Hess.....Fairmont, W. Va.

"Everyday Children's Dentistry"
Walter T. McFall.....Nashville, Tenn.

"Lower Stable Denture Technic"
A. Dale Miller.....Indianapolis, Ind.

"Pathology of Unerupted or Impacted Teeth"
Ernest D. Cofield.....Indianapolis, Ind.

"Dentist's First Responsibility to Child"
Lester D. Mitchell...Arkansas City, Ark.

"Atrophy of Alveolar Process About Maxillary Molars; Study Charts and X-Ray and Clinical Findings"
G. V. Reynolds.....Lexington, Nebr.

"Laboratory Work from a Practical Standpoint"
R. L. Minnick.....Stromburg, Nebr.

"Economical Laboratory Prosthesis"
William T. Faulconer....Kirksville, Mo.

"Casting Gold Against Gold, Using Two Different Investments"
L. H. Robinson....Webster Groves, Mo.

"Attachments for Fixed Replacements"
George B. Scott.....St. Louis, Mo.

"Temporomandibular Joint Abnormalities; Splints for Their Correction"
Travis E. Kallenbach.....St. Louis, Mo.

W. Clyde Davis Study Club

"Root Canal Work—One Hundred Cases"
S. F. Bergen.....Lincoln, Nebr.
R. J. Brigham.....Lincoln, Nebr.
G. L. Butler.....Lincoln, Nebr.
C. J. Henkleman.....Lincoln, Nebr.
E. R. Hinrichs.....Lincoln, Nebr.
M. O. Johnson.....Lincoln, Nebr.
G. R. Johnston.....Lincoln, Nebr.
W. W. Lamphere.....Lincoln, Nebr.
F. T. Lopp.....Lincoln, Nebr.

C. F. McAdams.....Lincoln, Nebr.
A. M. Pardee.....Lincoln, Nebr.
B. W. Tullis.....Lincoln, Nebr.
G. J. Wagner.....Lincoln, Nebr.
D. C. Yungblut.....Lincoln, Nebr.
L. R. Aksamit.....Crete, Nebr.
W. D. Wallace.....Friend, Nebr.
R. F. Scheiffele.....Valley, Nebr.

Missouri Unit of the American Society for the Promotion of Dentistry for Children

"Morphology of Deciduous Molars with Special Reference to Pulp Cavity and Its Relation to Cavity Preparation"
Thomas E. Knox.....St. Louis, Mo.

"Operative Procedures for Vital Deciduous Teeth"
Thomas C. Thompson.....St. Louis, Mo.

"Pulp Management of Deciduous Teeth"
Cornelia M. Thompson....St. Louis, Mo.

"Filling Materials and Their Application"
J. C. Gordon.....St. Louis, Mo.

"Modified Operative Procedure for First Permanent Molars"
R. C. Mallory.....St. Louis, Mo.

"Original Method of Recording Diagnosis and Operation on One Small Dental X-Ray Film"
J. Walter Ford.....St. Louis, Mo.

"Cast Restoration for Deciduous Teeth"
Ruth Martin.....St. Louis, Mo.

"Clinical Procedure as Carried Out in Clinic at St. Louis University School of Dentistry"
G. G. Riefling.....St. Louis, Mo.

"Parent Instruction in Care of Children's Teeth"
E. H. Schlueter.....St. Louis, Mo.

"Bilateral Space Maintainer"
Robert A. Harris, Jr.....St. Louis, Mo.

"Increasing Vertical Dimension by Means of Fixed and Removable Appliances and Use of Transparent Base Material in Full and Partial Denture Construction"
R. H. Davis.....Clarksburg, W. Va.
John B. Davis.....Clarksburg, W. Va.

"Reenforced Synthetic Angle Restoration"
S. J. McCarthy.....St. Louis, Mo.

"Method of Desensitizing Teeth for Cavity Preparation"
E. C. Will.....St. Louis, Mo.

"Maxillary Sinus in General Practice"
W. Ralph Hart.....St. Louis, Mo.

"Technic of Producing Accurate Castings with Minimum Chance of Error"
Maurice J. Coyle.....St. Louis, Mo.

"Two Methods of Improving Contact in Amalgam Restorations"
C. W. Robinson.....St. Louis, Mo.

"Adjustable Space Retainer That General Practitioner Can Make in Few Minutes"
J. A. Rapp.....Cape Girardeau, Mo.

Indiana University Dental School

"Casting Gold Inlays Direct to Porcelain Teeth for Artificial Dentures"
Sumner Pallardy.....Indianapolis, Ind.

"Inlay Cavity Preparation; Casting Showing Why Such Cavity Preparation Is Used"
John F. Johnston.....Indianapolis, Ind.

"Classification of Impacted Mandibular Third Molars and Tooth Division Technic for Removal of Impacted Teeth"
Glenn J. Pell.....Indianapolis, Ind.
G. Thaddeus Gregory..Indianapolis, Ind.

"Porcelain Inlays"
C. Faris Elzea.....Columbia, Mo.

"Impressions and Models for Porcelain Jacket Crowns"
L. L. DeYarman....Cedar Rapids, Iowa

"Construction of Trays for Taking Impressions in Immediate Denture Cases"
W. A. McKee.....Benton, Ill.

"Subalveolar Caries on Roots of Permanent Teeth"
Harold S. Jones.....Indianapolis, Ind.

"General Practitioner and Preventive Orthodontia"
Lewis E. Broverman...Wheeling, W. Va.

"Fractures and Osteomyelitis of the Jaws"
R. J. Yechout.....Omaha, Nebr.

"Casting Direct to Porcelain Teeth and Facings"
John H. Smiley...Oklahoma City, Okla.

St. Louis Society of Orthodontists

Some Causes and Preventives of Malocclusion

"Frequency of Various Etiologic Conditions"
O. W. Brandhorst
Frank S. Rodgers

"Premature Loss of Deciduous Teeth"
Earl C. Bean
L. B. Lundergan

"Premature Loss of Permanent Teeth"
J. H. Williams
V. A. Kimmey

"Prolonged Retention of Deciduous Teeth"
L. M. Shanley
B. W. Cordes

"Habits: Thumb, Finger and Tongue Sucking; Lip and Cheek Biting"
G. H. Herbert
J. E. Rook

"Habits: Mouth Breathing"
H. C. Pollock
E. W. Bedell

"Habits: Posture"
E. V. Holestine
A. C. Mogler

"Congenital Causes: Deficiency and Redundancy"
B. E. Lischer
H. F. Westhoff

"Photography"
Eric H. Golden

"Knicknacks"
August H. Westerfeld...St. Charles, Mo.

"Contour Amalgam Filling"
F. M. Fulkerson.....Sedalia, Mo.

"Impression Technic for Lower Dentures"
Fred W. Fender.....St. Louis, Mo.

"Cast Diaphragm"
O. F. Steber.....St. Louis, Mo.

"Use of Allantoin in Treatment of Chronic and Acute Oral Infections"
Cecil R. Conroy.....Belleville, Ill.

"Clinic"
William L. Conrad.....St. Louis, Mo.

"Porcelain Technic"
L. M. Kallenbach.....St. Louis, Mo.

"Dentistry for Children"
E. H. Jacobsmeyer.....Clayton, Mo.

"Routine Treatment of Infected Sockets"
H. G. Fisher.....St. Louis, Mo.

"Oral Syphilis"
C. Kenneth Ramage...Kansas City, Mo.

Washington University School of Dentistry

"Partial Veneer Crowns"
Frank H. Foerster.....St. Louis, Mo.

"Operative Procedures"
H. W. Rinesmith.....St. Louis, Mo.

"Extraction of Teeth"
William B. Spotts.....St. Louis, Mo.

"Designing Removable Partial Dentures"
J. R. O'Neal.....St. Louis, Mo.

"Cephalometric Diagnosis for Edentulous Mouths"
Thomas R. Moore.....St. Louis, Mo.

"Anomalies Met with in Extraction of Teeth"
Lester H. Jasper.....St. Louis, Mo.

"Root Canal Therapy"
J. M. Rose.....St. Louis, Mo.

"Intermediaries in Fixed Partial Dentures"
Thermon B. Smith.....St. Louis, Mo.

"Differential Roentgenographic Diagnosis"
W. E. Koch.....St. Louis, Mo.

"Case History and Diagnosis"
B. N. Pippin.....St Louis, Mo.

"Fixed Partial Dentures"
H. M. Biggs.....St. Louis, Mo.

"Newer Remedies"
R. G. Fobes.....St. Louis, Mo.

"Treatment of Caries"
J. W. D. Enloe.....St. Louis, Mo.

"Dental Materials"
Earl E. Shepard.....Edwardsville, Ill.

"Clinical Photography"
Joseph A. Laffler.....St. Louis, Mo.

"Extraction of Teeth"
Harold Z. Linders.....St. Louis, Mo.

"Biopsy in Dentistry"
H. B. G. Robinson.....St. Louis, Mo.

"Method of Securing Smooth Margins for Interproximal Alloy Fillings"
G. H. Bredell.....Perryville, Mo.

St. Louis University School of Dentistry

"Operative Dentistry"
T. E. Purcell.....St. Louis, Mo.
R. A. Barker.....St. Louis, Mo.

"Prosthetic Dentistry"
J. M. Grimm.....St. Louis, Mo.

"Cleft Palate Correction"
G. E. Pfeifer.....St. Louis, Mo.

"Crown and Bridge Work Ceramics"
Max Kornfeld.....St. Louis, Mo.
T. J. Davis.....St. Louis, Mo.
D. V. Carmichael.....St. Louis, Mo.

"Radiology"
C. A. LeMaster.....St. Louis, Mo.

"Radiodontia"
L. R. Main.....St. Louis, Mo.

"Oral Surgery"
H. P. Siddall.....St. Louis, Mo.

"Face Masks"
Arthur C. Engel.....St. Louis, Mo.

"Roentgenographic Display of Problems in Exodontia and Oral Surgery"
Val H. Frederich.....St. Louis, Mo.

"Pathologic Specimens and Models"
G. B. Broadhurst.....St. Louis, Mo.

"Gingivitis or Pyorrhea?"
Jerome S. Grosby.....St. Louis, Mo.

"Dental and Oral Anatomy"
Russell C. Wheeler.....St. Louis, Mo.
C. R. Lages.....St. Louis, Mo.
R. F. Bleiker.....St. Louis, Mo.

"Dental Pharmacology"
A. O. Shaklee (M.D.).....St. Louis, Mo.

"Indispensability of Roentgen Rays in Oral Diagnosis"
O. F. Freitag.....St. Louis, Mo.

"Device for Maintaining Opening in Maxillary Sinus Through Tooth Socket Where Infection Is of Dental Origin"
Ross C. Allen.....Kirksville, Mo.

"Cast Preparations for Immediate Replacements"
Ernest U. Bolton.....Louisville, Ky.

"Full Denture Impressions"
R. R. Blanchard.....Springfield, Ill.

"Pulp Stones and Devitalized and Impacted Teeth as a Factor in Systemic Disease"
John W. Seybold.....Denver, Colo.

"Must We Lose Bacteria Invaded Pulps Under Deep Caries?"
W. J. Brennan.....Omaha, Nebr.

"Simplified Molar Buccal and Lingual Arch Locks and Tubes, Handmade."
B. L. Kissel.....Joplin, Mo.

"Maintenance of Health of the Teeth and Their Supporting Tissues."
Rowe Smith.....Texarkana, Texas

THE ST. LOUIS SESSION

RADIO PROGRAM

Tuesday, October 25

Station KMOX
D. F. Lynch.....Washington, D. C.

Station WEW
R. C. Dalgleish....Salt Lake City, Utah

Station WIL
Leo J. Schoeny.....New Orleans, La.

Station KSD
Frank C. Cady.....Washington, D. C.

Station KWK
Vern D. Irwin.....Minneapolis, Minn.

Wednesday, October 26

Station KMOX
H. E. Strusser.....New York City

Station WEW
F. P. Bertram.....Oklahoma City, Okla.

Station WIL
Lester F. Clow.....Chicago, Ill.

Station KSD
R. C. Leonard.....Baltimore, Md.

Station KWK
Alfred Walker.....New York City

Thursday, October 27

Station KMOX
F. J. Wolfe.....New Orleans, La.

Station WEW
R. R. Gillis.....Hammond, Ind.

Station WIL
Edward Taylor.....Austin, Texas

Station KSD
Lon W. Morrey.....Chicago, Ill.

Station KWK
J. C. Brauer.....Iowa City, Iowa

LUNCHEON CLUB PROGRAM

Wednesday, October 26, 12:15 p.m.

Lions Club of St. Louis, Hotel Statler
Arthur H. Merritt.....New York City

Thursday, October 27, 12:15 p.m.

Rotary Club of St. Louis, Hotel Statler
Walter T. McFall.....Nashville, Tenn.

Friday, October 28, 12:15 p.m.

Optimist Club of St. Louis, Hotel Statler
Charles A. Sweet.....Oakland, Calif.

SCHOOL PROGRAM

Tuesday, October 25

Harris Teachers College, 1517 Theresa Ave. S.
(C. G. Vannest, principal)
Frank F. Lamons.....Atlanta, Ga.

Blewett High School, 5351 Enright Ave.
(L. R. Ernst, principal)
R. Holmes Mason.....Macon, Ga.

Beaumont High School, 3836 Natural Bridge Road
John E. Gurley.....San Francisco, Calif.

Central High School, 3616 N. Garrison St.
(D. H. Weir, principal)
Floyd Hogeboom.....Los Angeles, Calif.

Woerner Elementary School, 6131 Leona St.
(T. W. Schiek, principal)
Mary H. Westfall.....Indianapolis, Ind.

Fanning Elementary School, 3417 Grace St.
(F. J. Steuber, principal)
Dorothea F. Radusch.Minneapolis, Minn.

Humboldt Elementary School, 2615 S. Ninth St.
(C. L. Sampson, principal)
Julian W. Smith.....Belleville, Ill.

Baden Elementary School, 8724 Halls Ferry Road
(Armand Miller, principal)
Lon W. Morrey.....Chicago, Ill.

Irving Elementary School, 3829 N. Twenty-Fifth St.
(A. O. Leutheusser, principal)
Peter J. Warren.....Lakewood, Ohio

Shenandoah Elementary School, 3412 Shenandoah Ave.
(M. B. Johnson, principal)
O. E. Hoffman.....Des Moines, Iowa

Wednesday, October 26

Stowe Teachers College, 4318 St. Louis Ave.
(Ruth Harris in charge)
C. F. Deatherage.....Springfield, Ill.

Cleveland High School, 4352 Louisiana Ave.
(J. J. Maddox, principal)
Lester Gerlach.....Milwaukee, Wis.

McKinley High School, 2156 Russell Blvd.
(J. S. Edwards, principal)
J. M. Wisan.....Elizabeth, N. J.

Roosevelt High School, 3230 Hartford St.
(Charles Ammerman, principal)
Franklin B. Clemmer.....Chicago, Ill.

Woodward Elementary School, 725 Bellerive Blvd.
(L. M. Girault, principal)
E. H. Jones.....Cincinnati, Ohio

Dewey Elementary School, 6746 Clayton Ave.
(Mary A. Thompson, principal)
E. A. Branch.....Raleigh, N. C.

Mark Twain Elementary School, 5316 Rusking Ave.
(Charles E. Witter, principal)
E. C. Wetzel.....Milwaukee, Wis.

Stix Elementary School, 226 S. Euclid Ave.
(E. F. Taylor, principal)
A. E. Murphy.....Jefferson City, Mo.

Shaw Elementary School, 5329 Columbia Ave.
(J. R. Kerr, principal)
F. A. Bull.....Madison, Wis.

Clay Elementary School, 3820 N. Fourteenth St.
(Margaret M. Griffin, principal)
David Bennett Hill.....Salem, Ore.

Thursday, October 27

Soldan High School, 918 N. Union Ave.
(H. P. Stellwagon, principal)
Weston A. Price.....Cleveland, Ohio

Southwest High School, Arsenal St. and Kingshighway Blvd.
(Mr. Jeffrey, principal)
Thomas A. Gardner.....Omaha, Nebr.

Sumner High School, 4248 W. Cottage Ave.
(G. D. Brantley, principal)
Leon R. Kramer.....Topeka, Kan.

Vashon High School, 3026 Laclede Ave.
(Frank L. Williams, principal)
J. Robert Schumaker.....Chicago, Ill.

Mullanphy Elementary School, 4221 Shaw St.
(Paul M. Miller, principal)
John C. Brauer.....Iowa City, Iowa

Cupples Elementary School, 4908 Cote Brilliante Ave.
(C. F. Jones, principal)
Elsie Gerlach.....Chicago, Ill.

Gundlach Elementary School, 2931 Arlington Ave.
(W. D. Buchanan, principal)
Leo J. Schoeny.....New Orleans, La.

Hamilton Elementary School, 5819 Westminster Place
(Ida Lee Woody, principal)
C. M. Martin.....Louisville, Ky.

Clark Elementary School, 1021 N. Union Blvd.
(B. G. Shackelford, principal)
Chalmers B. Webster..Montgomery, Ala.

Cole Elementary School, 3935 Enright Ave.
(John M. Langston, principal)
Kenneth R. Gibson.....Detroit, Mich.

WOMEN'S PROGRAM

The Women's Auxiliary to the St. Louis Dental Society are official hostesses for the American Dental Association meeting.

Members of the committee will be stationed at hotels to welcome the visitors and give helpful information to make their visit enjoyable.

Monday, October 24

10:00 p.m. Monday night, October 24, the American Dental Association will be host to the members of the Association and their wives at the Auditorium, where a show will be given at 10:00 o'clock. This will consist of vaudeville and dancing. Admission will be by ticket only. Secure tickets when registering.

Tuesday, October 25

9:30 a.m. First General Meeting of the American Dental Association in the Opera House, Auditorium.

1:00 p.m. Women's luncheon in the Ballroom of the Hotel Statler. A fashion show will be staged by one of the smart shops of St. Louis. Tickets can be purchased from the committee in the hotel lobby. As only a limited number can be accommodated, tickets should be secured early. Price, $1.25.

8:30 p.m. Second General Meeting of the American Dental Association in the Opera House, Auditorium.

Wednesday, October 26

9:30 a.m. Wives of out-of-town American Dental Association members will be the guests of the Auxiliary at a breakfast given at the Coronado Hotel in the Club Caprice. The Coronado is located on Lindell Blvd. at Spring Street. After breakfast, busses will be waiting to take guests on a sight-seeing trip. As accommodations are limited to 500, tickets should be secured early. All visitors can secure tickets in the Hotel Statler lobby on presentation of American Dental Association membership card. Only one ticket will be given per family.

7:30 p.m. Ball in honor of the President, C. Willard Camalier, in the Gold room of the Hotel Jefferson. This will be a dinner dance, with entertainment. Tickets will be on sale in the Auditorium and Hotel Statler at $2.50 per person.

Thursday, October 27

8:30 p.m. Third General Meeting of the American Dental Association, in the Opera House, Auditorium.

Mrs. L. M. Kallenbach
Mrs. B. N. Pippin
Mrs. A. N. Blaney
Mrs. W. B. Spotts
Mrs. E. E. Haverstick
Mrs. O. A. Kelly
Mrs. E. C. Reisse, *Chairman*

SCIENTIFIC AND HEALTH EXHIBITS

List of Exhibitors as of August 10, 1938

Dental Departments of State Boards of Health

Illinois State Department of Public Health, Division of Dental Health Education and Illinois State Dental Society

Florida State Board of Health, Bureau of Dental Health, Jacksonville, Fla.

Kansas State Board of Health, Division of Dental Hygiene, Topeka, Kan.

Massachusetts Department of Public Health, Division of Child Hygiene, Boston, Mass.

Minnesota State Department of Health, Child Hygiene Division, Minneapolis, Minn.

Missouri State Department of Health, Dental Division, Bureau of Child Hygiene, Jefferson City, Mo.

Ohio State Department of Health, Bureau of Dental Hygiene, Columbus, Ohio

Oklahoma State Health Department, Oklahoma City, Okla.

Vermont State Department of Public Health, Burlington, Vt.

Schools

Atlanta-Southern Dental College, Atlanta, Ga. Ralph R. Byrnes, dean; Harry B. Johnston.

Baltimore College of Dental Surgery, Dental School, University of Maryland, Baltimore, Md.

University of Southern California, College of Dentistry, Los Angeles, Calif. William P. Harrison; Henry A. Linek

Columbia University, School of Dental and Oral Surgery, New York City

University of Detroit, School of Dentistry, Detroit, Mich.

Foundation for Dental Research of the Chicago College of Dental Surgery, Chicago, Ill.

Harvard Dental School, Boston, Mass.

Isaac Schour, University of Illinois, College of Dentistry, Chicago, Ill.

University of Michigan, College of Dentistry, Ann Arbor, Mich. Ralph F. Sommer; Floyd A. Peyton; Philip Jay and R. W. Bunting.

University of Minnesota, School of Dentistry, Minneapolis, Minn. Carl W. Waldron; Harold G. Worman

New York University, College of Dentistry, New York City

Northwestern University Dental School, Chicago, Ill. Edward H. Hatton; J. Robert Schumaker.

St. Louis University, School of Dentistry. T. E. Purcell; August A. Werner, M.D.; Alumni Association

University of Tennessee, School of Dental Hygiene, Memphis, Tenn.

Washington University, Schools of Medicine and Dentistry, St. Louis, Mo. Vilray P. Blair, M.D.; Sherwood Moore, M.D.; L. R. Boling and H. B. G. Robinson; Earl E. Shepard.

Individual Exhibits

Rigoberto Blanco, Buenos Aires, Argentine, S. A.

Howell Boatner, Springfield, Mo.

Scott P. Bowyer, Tulsa, Okla.

Walter Emerson Briggs, Attleboro, Mass.

P. H. Belding and L. J. Belding, Waucoma, Iowa

George W. Christiansen, Detroit, Mich.

Harold F. Curtis, Alexandria, Egypt.

G. M. Dorrance, Philadelphia, Pa.

A. C. Engel, St. Louis, Mo.

Eduardo Ferrora, Santiago, Chile, S.A.

H. M. Flickinger and Arkansas State Dental Association, Siloam Springs, Ark.

Victor H. Frank, Philadelphia, Pa.
O. L. Geyer, Grey Eagle, Minn.
Ray F. Goering, Duluth, Minn.
Charles G. Grover and Rosemary Kallminzer, Denver, Colo.
Charles A. Hess, Durant, Okla.
T. A. Hardgrove, Fond du Lac, Wis.
George M. Hollenback, Los Angeles, Calif.
Louis H. Jorstad (M.D.), St. Louis, Mo.
Roland M. Klemme and Nollner Burford, St. Louis, Mo.
Frank E. Bode, Cleveland, Ohio
Francis W. Nash, Scranton, Pa.
H. C. Pollock and E. V. Holestine, St. Louis, Mo.
Weston A. Price, Cleveland, Ohio
James Mark Prime, Omaha, Nebr.
Thomas E. Prosser, St. Louis, Mo.
Samuel Rabkin, Cincinnati, Ohio
Perley H. Roberts, Rochester, N. H.
Hamilton Robinson, St. Louis, Mo.
J. A. Salzmann, New York City
L. W. Schultz, Chicago, Ill.
C. Carroll Smith, Peoria, Ill.
Floyd E. Straith, Detroit, Mich.
H. W. Titus, Eugene, Ore.
Dorothy B. Waugh, Philadelphia, Pa.
Russell C. Wheeler, St. Louis, Mo.
George B. Winter, St. Louis, Mo.

Organizations

American Association of Dental Editors.
American Dental Assistants Association.
American Dental Association Insurance Committee.
American Dental Association Bureau of Public Relations.
American Dental Association Council on Dental Therapeutics and Bureau of Chemistry.
American Dental Association Relief Commission and Relief Fund.
American Dental Association Research Commission.
American Dental Hygienists' Association.
American Dietetic Association.
American Medical Association.
American Pharmaceutical Association, St. Louis Study Club of Dentistry and St. Louis College of Pharmacy.
American Red Cross.
American Society for the Control of Cancer.
Bergen Street School, Board of Education, Newark, N. J.
Boy Scouts of America.
Chicago Tumor Institute, Chicago, Ill.
Des Moines Public Schools, Bureau of Dental Hygiene, Des Moines, Iowa.
Glen Lake Sanatorium, Oak Terrace, Minn.
Illinois State Medical Society, Educational Committee.
John Lewis Childs School, Floral Park, N. Y.
Louisiana State Hospital and Welfare Board, Baton Rouge, La.
The Mayo Clinic, Rochester, Minn.
Medical-Dental Service Bureau of St. Louis, St. Louis, Mo.
Metropolitan Life Insurance Co., New York City.
Missouri Social Hygiene Association, Inc., St. Louis, Mo.
Missouri State Dental Association, History Committee.
Missouri State Dental Association, Economics Committee.
Municipal Tuberculosis Sanitarium, Chicago, Ill.
Murry and Leonie Guggenheim Dental Clinic, New York City.
National Tuberculosis Association and Missouri Tuberculosis Association.
New York City Cancer Committee and American Society for the Control of Cancer.
New York City Department of Health, Division of Dental Service, New York City.
New York Institute of Clinical Oral Pathology, New York City.
Rochester Dental Dispensary, Rochester, N. Y.
St. Louis Public Schools, St. Louis, Mo.
Frank E. Simpson Radium Institute, Chicago, Ill.
St. Louis Department of Public Welfare, Municipal Dental Clinics, St. Louis, Mo.
St. Louis Board of Education, St. Louis, Mo.
United Charities. Inc., St. Louis, Mo.
U. S. Army, Army Medical Museum, Washington, D. C.
U. S. Bureau of Home Economics, Department of Agriculture, Washington, D. C.
U. S. Department of Justice, Federal Bureau of Investigation, Washington, D. C.
U. S. Department of Labor, Children's Bureau, Washington, D. C.
U. S. Food and Drug Administration, Washington, D. C.
U. S. Public Health Service, Washington, D. C.
Veterans Administration, Hines, Ill.
Veterans Administration Facility, St. Cloud, Minn.
West Virginia State Dental Society and Wheeling Dental Society.
Zoller Memorial Dental Clinic, Billings Hospital, University of Chicago, Chicago, Ill.

ASSOCIATED GROUPS

AMERICAN ACADEMY OF RESTORATIVE DENTISTRY

The American Academy of Restorative Dentistry will meet in the Ivory Room of the Jefferson Hotel, St. Louis, October 22-23. The

president will call the meeting to order early Saturday morning. Luncheon (Sunday) will be served in the Crystal Room.

A. F. SCHOPPER, *Secretary*
Professional Building,
Kansas City, Mo.

AMERICAN SOCIETY OF ORAL SURGEONS AND EXODONTISTS

The twentieth annual meeting of the American Society of Oral Surgeons and Exodontists will be held at the Jefferson Hotel, St. Louis, October 20-21-22, in the Crystal Room. A dinner dance will be given October 21 in the Ivory Room.

HARRY BEAR, *Secretary*,
Professional Building,
Richmond, Va.

NATIONAL ASSOCIATION OF DENTAL EXAMINERS

The National Association of Dental Examiners will hold its annual meeting October 22-23 at the Hotel Statler, St. Louis, in the Adam Room.

R. P. THOMAS, *Secretary*,
Heyburn Building,
Louisville, Ky.

AMERICAN COLLEGE OF DENTISTS

The American College of Dentists will hold its annual convocation October 23 in the Ballroom of the Hotel Statler, St. Louis.

O. W. BRANDHORST, *Secretary*
Lister Building,
St. Louis, Mo.

AMERICAN ASSOCIATION OF DENTAL EDITORS

The American Association of Dental Editors will hold its annual meeting October 22, Hotel Statler, St. Louis. The meeting and banquet will be held in the Daniel Boone Room.

O. W. BRANDHORST, *Secretary*,
Lister Building,
St. Louis, Mo.

AMERICAN SOCIETY FOR THE PROMOTION OF DENTISTRY FOR CHILDREN

The American Society for the Promotion of Dentistry for Children will hold its annual meeting October 24 at the Jefferson Hotel, St. Louis. The meeting will be held in Parlor I; luncheon in the Crystal or Ivory Room.

J. C. BRAUER, *Secretary*,
University of Iowa, School of Dentistry,
Iowa City, Iowa

AMERICAN FULL DENTURE SOCIETY

The American Full Denture Society will hold its annual meeting at the Jefferson Hotel, St. Louis, October 22-23. The Saturday meeting will be held in the Gold Room; the Sunday meeting in Parlor 9.

H. L. HARRIS, *Secretary*,
Lowry Building,
St. Paul, Minn.

AMERICAN ASSOCIATION OF WOMEN DENTISTS

The seventeenth annual meeting of the American Association of Women Dentists will be held at the Hotel Statler, St. Louis, October 24, with headquarters in Room 106.

The breakfast meeting will be held in Parlor A.

ASSOCIATION OF MILITARY DENTAL SURGEONS

The Association of Military Dental Surgeons will hold its annual dinner in the Daniel Boone Room of the Hotel Statler, St. Louis, October 25.

NATIONAL SOCIETY OF DENTURE PROSTHETISTS

The National Society of Denture Prosthetists will hold its meetings October 17-22 at the Jefferson Hotel, St. Louis.

ANNUAL A.D.A. MOUTH HYGIENE LUNCHEON

The annual A.D.A. Mouth Hygiene Luncheon will be held at the Hotel Statler in Parlor A, October 26.

E. L. PETTIBONE, *Chairman*,
14508 Detroit Avenue,
Cleveland, Ohio

MOUTH HYGIENE WORKERS' BREAKFAST

The Mouth Hygiene Workers' Breakfast will be given October 25, Hotel Statler, Daniel Boone Room.

E. L. PETTIBONE

AMERICAN ASSOCIATION OF PUBLIC HEALTH DENTISTS

The American Association of Public Health Dentists will hold its meeting October 23-24 at the Hotel Statler, St. Louis, in the Daniel Boone Room.

F. C. CADY,
U. S. Public Health Service,
Washington, D. C.

ADVISORY BOARD FOR DENTAL SPECIALTIES

The Advisory Board for Dental Specialties will hold its meeting October 24, Hotel Statler, St. Louis, Room 104.

HAROLD J. LEONARD,
630 W. 168th St.,
New York City

AMERICAN DENTAL ASSISTANTS ASSOCIATION

The fourteenth annual meeting of the American Dental Assistants Association will be held October 24-28 at the DeSoto Hotel, St. Louis.

LUCILE S. HODGE, *Secretary,*
401 Medical Arts Building,
Knoxville, Tenn.

AMERICAN DENTAL HYGIENISTS' ASSOCIATION

The American Dental Hygienists Association will hold its annual meeting October 24-28 at the Claridge Hotel, St. Louis.

DAISY M. BELL, *Secretary,*
974 Amherst Street,
Buffalo, N. Y.

AMERICAN ACADEMY OF PERIODONTOLOGY

The American Academy of Periodontology will hold its annual meeting October 20-22 at the Coronado Hotel, St. Louis.

RAYMOND E. JOHNSON, *Secretary,*
824 Lowry Medical Arts Bldg.,
St. Paul, Minn.

PAN-AMERICAN ODONTOLOGICAL ASSOCIATION

The Pan-American Odontological Association will hold its meeting and luncheon in the Adam Room of the Hotel Statler, October 24.

R. H. BRODSKY,
205 W. 57th Street,
New York City.

RESEARCH COMMISSION OF THE AMERICAN DENTAL ASSOCIATION

The Research Commission of the A.D.A. will meet October 23 in Room 106, Hotel Statler, St. Louis.

INTERNATIONAL COLLEGE OF DENTISTS

The International College of Dentists will hold its meeting October 23, at the Jefferson Hotel, St. Louis.

AMERICAN DENTAL GOLF ASSOCIATION

The American Dental Golf Association will hold its meeting October 24; Calcutta Pool, Adam Room, October 23; prize dinner October 25, Parlor A, Hotel Statler.

AMERICAN DENTAL TRAPSHOOTERS LEAGUE

The American Dental Trapshooters League will hold its annual trap and skeet shoot over the grounds of the St. Louis Gun Club, 15 miles out on Highway 66, October 24, at 1:00 p.m. There will be 100 targets at 16 yards regulation; also 100 targets skeet. Suitable prizes will be awarded in each event. The St. Louis Gun Club is one of the best equipped gun clubs in St. Louis, having three regulation trap houses and two skeet fields. Bring your guns. Ammunition can be had at the club house. T. L. Pepperling, 3500 N. Grand Avenue, St. Louis, has been appointed to take charge of this event.

ATTENTION GOLFERS

The eighteenth annual tournament of the American Dental Golf Association will be held in St. Louis, October 24, starting at 8:00 a.m. Three of the finest courses in the Middle West have been secured for the tournament and October always finds the greens and fairways in the most perfect condition of the whole year.

Class A (0-8 inclusive) will play at the Algonquin Country Club.

Class B (9-16 inclusive) at Sunset Hill Country Club.

Class C (17-24 inclusive) at the Glen Echo Country Club.

Arrangements have been made by the Local Committee whereby members of the American Dental Golf Association may enjoy the courtesy of many other clubs during their stay in St. Louis.

The Calcutta pool auction and dinner will be held in the Adam room of the Hotel Statler, October 23, at 7:00 p.m. No member of the American Dental Golf Association can afford to miss this feature of the meeting.

The Algonquin and Glen Echo Country Clubs are two of the oldest clubs in the St. Louis district, with subirrigated fairways and greens. The tree lined fairways over gently rolling terrain and with a comparative absence of rough will gladden the eye of the nature lover and the heart of the duffer with a slice. The Algonquin course is 6,203 yards; par 71. The Glen Echo course is 6,207 yards; par 71.

The Sunset Hill Country Club is perched on the hills looking westward over the beautiful Meramec River Valley. Here too the fairways and the greens are carefully cared for. The Sunset Hill course is 6,307 yards; par 71.

TOURNAMENT SCHEDULE

Monday, October 24, 1938, any time after 8:00 a.m.

AMERICAN DENTAL GOLF CHAMPIONSHIP

Algonquin Country Club
36-hole medal play
Champion ..... Prize

Runner-up .....Prize
36-hole low gross.....Calcutta event
This event is open to any player sold in the Calcutta Pool, including the field. Prizes awarded for the first to ninth place inclusive.
36-hole medal play.....
.....Handicap championship
This event is open to any contestant who desires to play thirty-six holes on the course determined by his handicap:
Class A, 18 hole event
Handicaps, 0-8 inclusive, Algonquin Country Club.
First 18 holes only can be counted in this competition.
Low gross.....Prize Low net.....Prize
Second low gross. Prize Second low net..Prize
Class B, 18 hole event
Handicaps 9-18 inclusive, Sunset Hill Country Club
First 18 holes only can be counted in this competition.
Low gross.....Prize Low net.....Prize
Second low gross. Prize Second low net..Prize
Class C—18 hole event
Handicaps 17-24 inclusive, Glen Echo Country Club
First 18 holes only can be counted in this competition.
Low gross.....Prize Low net.....Prize
Second low gross. Prize Second low net..Prize
Bring properly attested handicap.

MEMBERSHIP COMMITTEE MEETING

The Membership Committee of the A.D.A. will meet on Tuesday, October 25, at 3:00 p.m., in Room 104 of the Hotel Statler.

PAUL W. ZILLMAN, *Chairman.*

ECONOMICS COMMITTEE

The Economics Committee will meet at 10:00 a.m. October 23, at the Hotel Statler, Room 104. A complete report of the National Health Conference will be presented. The recommendations of the Technical Committee of the Interdepartmental Committee to Coordinate Health and Welfare will be discussed. All members and deputies of the Economics Committee are urged to be present.

E. H. BRUENING, *Chairman.*

NEW YORK STATE DELEGATES

The New York State Delegates will have a breakfast in Parlor A of the Hotel Statler at 9:00 a.m. October 25.

WASHINGTON UNIVERSITY

Washington University, Class of 1929, will hold a reunion and banquet at the Missouri Athletic Club October 26 at 7:00 p.m.

A.D.A. PAST PRESIDENTS' CLUB

The Past Presidents' Club of the American Dental Association will hold its annual luncheon at 12:30 October 25, in Room 104, Hotel Statler.

The annual address will be given by Sheppard W. Foster of Atlanta, Ga. Every Past President in attendance at the meeting is urgently requested to be present at this luncheon.

HOMER C. BROWN,
1816 Franklin Avenue,
Columbus, Ohio.

HOUSE OF DELEGATES LUNCHEON

The House of Delegates Luncheon will be held in the Gold Room of the Hotel Jefferson, Monday, October 24, at 12:30 p.m.

OMICRON KAPPA UPSILON FRATERNITY

Omicron Kappa Upsilon will hold its luncheon October 25, 12 m., at the Jefferson Hotel.

G. W. TEUSCHER, *Secretary,*
311 E. Chicago Avenue,
Chicago, Ill.

DELTA SIGMA DELTA FRATERNITY

The fifty-fourth annual meeting of the Supreme Chapter of Delta Sigma Delta Fraternity will be held in the Coronado Hotel, St. Louis, October 24. The first session, to be held at 9:30 a.m., will be followed by the usual complimentary luncheon to the members. The afternoon session will be held immediately thereafter, at which time initiations into the Supreme Chapter will take place. The annual banquet will be at 6:30 in the Coronado Hotel, to which ladies will be invited. When registering for the banquet, members must present cards to the committee in charge.

Requests for hotel reservations should be sent to Leo F. Marre, Chairman Hotel Reservations Committee, Missouri Building, St. Louis.

JOSEPH H. WILLIAMS,
Supreme Grand Master.

ALPHA OMEGA FRATERNITY

Alpha Omega Fraternity will maintain official headquarters at the De Soto Hotel during the sessions of the American Dental Association in St. Louis. All members are requested to register at fraternity headquarters and are invited to attend the dinner, notice of which will be posted in due time, in the hotel. Tickets can be obtained at the official headquarters.

WILLIAM RICH, *Supreme Scribe,*
156 West 165th Street,
Bronx, N. Y.

PSI OMEGA FRATERNITY

Psi Omega headquarters during the meeting of the American Dental Association at St. Louis, October 24-28, will be at the Hotel Jefferson. All visiting members are requested to register in this hotel on arrival. The annual banquet of the National Alumni Chapter will be held at the Hotel Jefferson, October 24 at 6:30 p.m. All Psi Omegas and their families are invited to be present. The executive meeting of the National Alumni Chapter will be held in the headquarters room at the hotel, the exact date and hour to be announced later.

L. R. Main (Beta Zeta '07) is chairman of the Local Arrangements Committee.

JOHN W. RICHMOND, *Grand Master,*
1008 Huron Building,
Kansas City, Kan.

XI PSI PHI FRATERNITY

The annual banquet of the Xi Psi Phi Fraternity will be given October 24 at the Mayfair Hotel, St. Louis, at 6:30 p.m. All members of the fraternity are cordially invited to be present.

GEORGE A. COLEMAN, *Supreme President,*
15th and Locust Sts.,
Philadelphia, Pa.

Historic old Court House, St. Louis, showing old Slave Market.

American Dental Association

St. Louis, Missouri — October 24-28, 1938

HOTEL RESERVATIONS

To secure hotel accommodations for the 1938 Session, consult the rate list and fill out the attached blank. Mail this immediately to the hotel of your first choice or to the Housing Committee, Room 108, Hotel Statler, St. Louis, Mo. Confirmation will be sent to you by the hotel.

Second and third choices of hotel should be indicated. If the reservation cannot be made at any of the hotels of your choice, the Housing Committee will place you in as favorable a hotel as possible and will notify you.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, namely, to occupy the room at the time agreed upon, please write or wire the hotel releasing the room, in order that it may be available for other members.

RAILROAD FARES TO ST. LOUIS

Because of the reduced regular rates and round-trip fares, there is no longer any arrangement for convention rates and, therefore, there will be no convention certificates available as in the past. The new low rates for passage in Pullmans and the lower rates for travel in coaches will be in force. Summer excursion rates will be available from some sections of the country. Inquire of your station agent as to the most economical fare.

APPLICATION FOR HOTEL ACCOMMODATIONS

AMERICAN DENTAL ASSOCIATION

St. Louis, Mo. October 24-28, 1938

HOTEL.....1st choice

HOTEL.....2nd choice

HOTEL.....3rd choice

Kindly reserve the following:

.....Rooms with bath for.....persons $.....per room

.....Rooms without bath for.....persons $.....per room

Arriving on October.....at.....a.m.....p.m.

ROOMS TO BE OCCUPIED BY:

NAME	ADDRESS IN FULL
.....	.....
.....	.....
.....	.....

NOTE TO HOTEL NAMED AS FIRST CHOICE: If the hotel of first choice is unable to make the reservation requested, this application should be forwarded at once to the Housing Committee, Room 108, Hotel Statler, St. Louis, Mo.

SCHEDULE OF RATES

ALL ROOMS WITH BATH*

Hotels	*Single*	*Double*	*Twin Beds*
AMERICAN 6 North 7th St.	$2.50	$4.00	$5.00
AUDITORIUM 1803 Pine St.	2.50	3.50	4.50
BILTMORE 3643 Washington Blvd.	1.50	2.50	3.00
CHASE 212 N. Kingshighway Blvd.	2.50–3.00–3.50–4.00 Apartments (4 persons), 12.00	4.00–5.00–6.00	5.00–6.00
CLARIDGE 18th and Locust St.	2.00–2.50–3.00	4.00–4.50–5.00	4.00–4.50–5.00 6.00
CONGRESS 275 N. Union Blvd.			6.00
DESOTO 1014 Locust St.	2.00–2.50–3.00	3.00–3.50–4.00	3.50–4.00–5.00 6.00
CORONADO 3701 Lindell Blvd.	2.50–3.00–3.50 4.00–4.50–5.00–6.00 Parlors (wall beds), 5.00, single; 6.00, double 2 room suites (3 persons), 7.50 Parlor suites, 5.00 6.00–7.00–8.00–9.00 10.00–11.00–12.00	3.50–4.00–4.50 5.00–6.00	4.00–4.50–5.00 5.50–6.00–7.00
FAIRGROUNDS 3644 Natural Bridge Blvd,	2.00–2.50	3.00–4.00	
FOREST PARK 4910 W. Pine Blvd.	3.00 Apartments (2-4 persons), 3.00 person		4.00–6.00
GATESWORTH 245 Union Blvd.	3.00 Suites (4 persons), 8.00	4.00	5.00

*Extra cot, $1.00. R es on rooms without bath on request.

SCHEDULE OF RATES (Continued)

Hotels	*Single*	*Double*	*Twin Beds*
JEFFERSON 415 North 12th Blvd.	$3.00–3.50–4.00 4.50–5.00–5.50 Suites (single), 6.00 8.00–10.00–17.50 Suites (double), 8.00 12.00–19.50	$4.00–4.50–5.00 5.50–6.00–7.00 7.50	$5.00–6.00–7.00 7.50–8.00
KINGS-WAY 108 N. Kingshighway Blvd.	2.00–2.50–3.00–3.50 Suites, 5.00–6.00–7.00 8.00	3.00–3.50–4.00	4.00–5.00–6.00
LENNOX 825 Washington Ave.	3.00–3.50–4.00	4.50–5.00–5.50 6.00	5.00–5.50–6.00 6.50–7.00
MAJESTIC 200 North 11th St.	3.00	4.00–5.00	6.00
MARK TWAIN 116 North 8th St.	2.00	3.50–4.00–4.50	4.50–5.00–5.50
MARQUETTE 18th and Washington Blvd.		3.00	4.00
MARYLAND 205 North 9th St.	2.50	3.50–4.00	4.00–4.50
MAYFAIR 8th and St. Charles St.	3.00	4.50–5.00–5.50 6.00–6.50–7.00	5.50–6.50
MELBOURNE 3601 Lindell Blvd.	2.50–3.00–3.50–4.00	4.00–4.50–5.00 6.00	4.50–5.00–6.00 7.00
PARKEDGE 4907 W. Pine Blvd.		4.50	6.00
PARK PLAZA 220 N. Kingshighway Blvd		5.00	6.00
ROOSEVELT 4901 Delmar Blvd.		3.00 (shower only)	
STATLER 9th and Washington Blvd.	2.50–3.00–3.50–4.00 4.50–5.00 Parlor (wall bed), 7.00 single; 9.00 double Parlor suites (2 or 4), 15.00–22.00	4.50–5.00–6.00 6.50–7.00	5.00–6.00–6.50 7.00–8.00–9.00
WARWICK 1428 Locust St.	2.00–2.50–3.00	3.50–4.00–4.50 5.00	4.00–5.00–6.00
YORK 8 South 6th St.	2.00–2.50	3:50–4.00	4.50

ST. LOUIS, HOST TO AMERICAN DENTISTS OCTOBER 24, 25, 26, 27, 28, 1938

INTERESTS of the dental profession throughout the United States will converge in St. Louis October 24 to 28, 1938, during the American Dental Association's Eightieth Annual Session, and word from the Queen City indicates that a royal welcome and real hospitality are in store for dentists attending.

Reports from St. Louis indicate that city officials, hotel owners and business and professional men are ready to show the American Dental Association that St. Louis, because of its central location and vast facilities, is the foremost convention city of the United States.

Pierre Laclede Liguest could not have pictured the magnificent metropolis that was to grow from the fur trading post which he founded, 173 years ago, on the muddy west bank of the Mississippi River, and called St. Louis.

Who could have imagined that the log cabins of the pioneers were but a forerunner of majestic edifices of brick and stone, steel and concrete—and costing millions of dollars?

Queen city of the rich Mississippi Valley, St. Louis is internationally noted for the magnificence of its buildings—public, commercial, educational and eleemosynary. Today, the city's principal municipal and judicial buildings are grouped about a beautiful plaza, a modern transformation accomplished by intelligent planning, and made possible by bond issues exceeding $100,000,000.

This group includes the architecturally beautiful Municipal Auditorium, costing $5,000,000; the Civil Courts Building, Federal Court and Custom House, and the million-dollar Soldier Memorial Building. The City Hall and Municipal Courts Building also face the plaza, and nearby stand the huge new Police Headquarters and auxiliary buildings, and the Public Library. A few blocks west is the new Post Office, costing more than $4,000,000. The thirty-one story Telephone Building, huge Railway Exchange and other modern office buildings, the majestic New Cathedral, Masonic Temple, Scottish Rite Cathedral, and other modern structures of many types have brought St. Louis world renown.

St. Louis is rich in the history and traditions of pioneer America, with landmarks of dauntless men and epochal events.

At the east door of the famous Old Courthouse, there still stands the stone auction block on which slaves were sold. This historic structure also is noted as the scene of the Dred Scott slave case and the starting point of the Daniel Boone Trail.

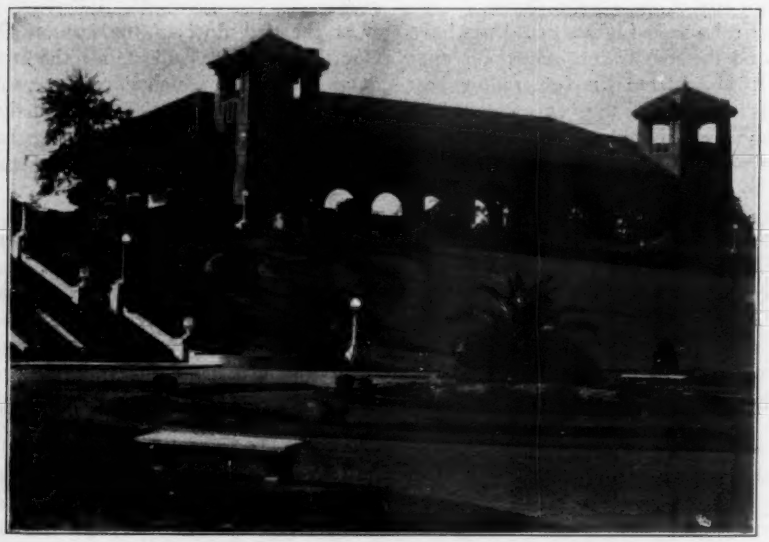
The second largest public park in America, Forest Park, is a veritable paradise of arboreal and floral beauty. Magnificent trees of many varieties cast their cool shadow over a vast and rolling greensward, and here and there man's handicraft has augmented nature's lavish art with picturesque lagoons, lily ponds and other landscape adornments. Even lifelong residents of St. Louis familiar with every footpath of the park's 1,400 acres find continuing pleasure in their daily walks or drives through its lanes and winding roadways.

In the heart of this fairyland, the world-famous Municipal Opera is presented nightly during the summer in a splendid al fresco theatre.

In the park also will be found St. Louis' splendid Art Museum; the Jefferson Memorial, where the Lindbergh trophies are displayed; the Jewel Box, a

magnificent modernistic botanical exhibit of rare beauty, and the internationally known St. Louis Zoo.

St. Louis has, within its own environs, two distinguished universities, Washington and St. Louis. Both are widely known for the excellence of their dental and medical schools, and other departments are accorded prominent standing among the universities of the country. A Jesuit institution, St. Louis University was the first university in the west. Its buildings, located from Grand Avenue westward in mid-St. Louis, include St. Francis Xavier's College Church. Washington University, at Forsythe and Skinker boulevards, in western St. Louis, has one of the country's most beautiful campuses.



Shelter House, Forest Park, St. Louis.

MEMBERS OF THE HOUSE OF DELEGATES 1938

DELEGATES AND ALTERNATES

ALABAMA

Delegates
Kirkland, Olin, Shepherd Bldg., Montgomery
Cannon, C. C., Fayette
Bryans, H. H., First National Bank Bldg., Birmingham

Alternates
McGavock, R. J., Woodward Bldg., Birmingham
Webb, Francis A., Van Antwerp Bldg., Mobile
Sapienza, B. F., Comer Bldg., Birmingham

ARIZONA

Delegate
Smith, Franklin, Professional Bldg., Phoenix

Alternate
Fee, Archibald G., Consolidated Bank Bldg., Tucson

ARKANSAS

Delegates
Sternberg, I. M., Merchants National Bank Bldg., Fort Smith
Neel, H. S., Stuttgart

Alternates
Gibbs, M. D., Medical Arts Bldg., Hot Springs
Hunt, W. R., Jr., Clarksville

SOUTHERN CALIFORNIA

Delegates
Harding, J. C. A., First Nat'l Bank Bldg., San Diego
Casto, Frank M., 801 Silverado, La Jolla
Buckley, J. P., 803 Taft Bldg., Los Angeles
Rice, C. Stanley, Roosevelt Bldg., Los Angeles
McLean, David W., 3780 Wilshire Blvd., Los Angeles
Reagan, Charles A., 1930 Wilshire Blvd., Los Angeles
Goodman, Nye White, Story Bldg., Los Angeles
Thompson, Walter S., Roosevelt Bldg., Los Angeles

Alternates
Hogeboom, Floyd Eddy, Pellissier Bldg., Los Angeles
Furnas, I. L., 928 Silverado, La Jolla
Lucas, Carl D., Brockman Bldg., Los Angeles
Dunn, A. L., 1836 State St., Santa Barbara
Brownson, E. Ray, 3875 Wilshire Blvd., Los Angeles
Ford, L. E., 122 E. 16th St., Los Angeles
Boyd, Bert, Roosevelt Bldg., Los Angeles
Webber, Chester H., Bank of America Bldg., San Diego

CALIFORNIA

Delegates
Robinson, Wilfred H., 1706 Broadway, Oakland
Gurley, John E., 350 Post St., San Francisco
Moose, Sanford M., 450 Sutter St., San Francisco
Sloman, Ernest G., 344 Fourteenth St., San Francisco
Sweet, Charles A., 2940 Summit St., Oakland
Kirtland, Howard B., 7 Pacific Southwest Bldg., San Luis Obispo
Selleck, George A., 450 Sutter St., San Francisco

Alternates
Millberry, Guy S., First & Parnassus Ave., San Francisco
Gill, J. Raymond, 450 Sutter St., San Francisco
Moore, James Franklin, 1022 Franklin Bldg., Oakland
Bishop, Lyall O., Bank of America Bldg., Berkeley
McKeehan, C. Porter, 1805 Park Blvd., Oakland
Wagner, Ralph O., 2940 Summit St., Oakland

COLORADO

Delegates
Johnston, Lloyd W., Republic Bldg., Denver
Brown, C. F., Mack Bldg., Denver

Alternates
Grover, Charles G., 3401 Federal Blvd., Denver
Devitt, Oliver H., Republic Bldg., Denver

CONNECTICUT

Delegates
Myers, J. J., 1115 Main St., Bridgeport
Vivian, C. W., 58 Elbridge Road, New Britain
Bray, J. A., 99 Pratt St., Hartford
Murray, W. J., 74 State St., New London
Kilduff, Gilbert, 111 West Main St., Waterbury

Alternates
Hicks, Henry, 5 Glen Court, Greenwich
Hertz, J. D., 46 Bedford St., Stamford
Rosoff, A. B., 265 Church St., New Haven
Peterson, C. E., 34 Park Place, Rockville
Diana, Henry Francis, 300 Main St., New Britain

DELAWARE

Delegate
Traynor, P. A., 807 Washington St., Wilmington

Alternate
Atkins, W. B., Millsboro

DISTRICT OF COLUMBIA

Delegates
Weakley, A. D., 1029 Vermont Ave. N. W., Washington, D. C.
Fitzgibbon, D. J., 1801 Eye St. N W., Washington, D. C.
Brown, J. W., 1726 Eye St. N. W., Washington, D. C.

Alternates
Cole, C. D., 1835 Eye St. N. W., Washington, D. C.
Colvin, E. M., Jr., 1029 Vermont Ave. N. W., Washington, D. C.
Bassett, C. T., 1726 Eye St. N. W., Washington, D. C.

FLORIDA

Delegates
Harlow, Lloyd N., Bradenton
Lunsford, E. C., Huntington Bldg., Miami
Meyer, F. P., Hall Bldg., St. Petersburg

Alternates
Sears, A. W., Professional Bldg., Jacksonville
Thompson, E. L., Atlantic Block, Daytona Beach
Cummins, R. D., West Coast Title Bldg., St. Petersburg

GEORGIA

Delegates
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Banks, W. H., Montezuma

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Weichselbaum, William, Sr., Savannah
Darby, L. H., Vidalia

HAWAII

Delegates
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Freitas, Henry William, Young Bldg., Honolulu

Alternate
Wall, A. C., Boston Bldg., Honolulu

IDAHO

Delegate
Brookfield, B. M., Idaho Falls

Alternate
Seibert, E. F., Boise

ILLINOIS

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Converse, A. E., Ridgely Bldg., Springfield
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Bolks, H. G., Davidson Bldg., Sioux City
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Brucher, W. J., Le Mars

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Jarrell, M. F., Commercial Bank Bldg., Alexandria

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Tucker, E. W., Butte

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Burgess, J. R., Glasgow

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Bruening, E. H., City National Bldg., Omaha

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Olive, R. M., Fayetteville

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Dietz, R. H., Pawnee

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Bettman, M. M., Medical Arts Bldg., Portland

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Robinson, S. C., Selling Bldg., Portland
Harris, M. C., Tiffany Bldg., Eugene

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Bunch, G. A., Cheraw

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Timmerman, T. L., Laurens

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Stansbery, C. J., Medical and Dental Bldg., Seattle

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Olsen, O. T., Medical and Dental Bldg., Seattle

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Cleek, L. D., Bartley

Alternates
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Lett, W. B., Caretta
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Alternate
Wekenman, C. W., U. S. Public Health Service, Washington, D. C.

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Alternate
Mangold, Marson W., U. S. Naval Dental School, Washington, D. C.

ARMY

Delegate
Peavey, Harry C., Jefferson Barracks, Mo.

Alternate
Anderson, Lawrence K., Jefferson Barracks, Mo.

FOR GOOD TEETH
TAKE CARE OF THEM
HABIT OF HEALTH
DECAY
THIS OR THIS OR THIS ?
UP AGAIN I FORGOT TO BRUSH TEETH
2 TIMES TO REMEMBER
THEY WHISTLE WHILE THEY BRUSH

Winning posters in the 1938 Missouri State Poster Contest. Right: First awards; upper left: second awards; lower left: third awards.

CURRENT LITERATURE

Dental Tissues in Osteitis Deformans

By M. A. Rushton

Three teeth from two cases of osteitis deformans were studied histologically. The general findings included calcification within the pulp and hypercementosis, preceded by resorption at the apical end of the roots. The calcified masses within the pulps were hyalin-like, containing few tubules and apparently derived from several calcification centers. One of the teeth examined, a supernumerary, showed advanced root resorption. —*Guy's Hosp. Rep.*, 88:163, April 1938.

Hamilton Robinson.

Tumor of the Palm Having the Structure of a Mixed Tumor of the Salivary Glands

By L. C. Simard

Mixed tumors of the salivary glands have been reported only occasionally in positions outside the cephalic region. Seven cases of these heterotropic neoplasms in the literature are reviewed. The author's case was that of a 76-year-old woman with a tumor, 50 by 45 by 42 mm., in the hypothenar region of the left hand. It had grown slowly for ten years and did not recur one and one-half years after removal. Histologically, epithelium of various types, including malpighian strands and glandular types, and connective tissue of various types were seen. Theories of the origin of this oral tumor in its heterotropic location are discussed.— *Am. J. Cancer*, 33:182, June 1938.

Hamilton Robinson.

Vitamin C Excretion in Children with Particular Reference to Rheumatic Fever

By J. D. Keith and E. M. Hickmans

Since the isolation of vitamin C in pure form as ascorbic acid, more accurate methods of determination for it have been developed. Assays on biologic material under different conditions have been made and many "pet theories" have felt the influence of factual investigation, although the relation of subclinical scurvy and mild vitamin C deficiency to the etiology and course of various diseases is almost as obscure as before the introduction of the present tests.

In this study, the excretion of vitamin C in normal children and in children suffering from various diseases was measured. In a group of thirty-nine children showing no evidence of infection, the excretion varied from 5.5 mg. for the younger group to 11.5 mg. for the older. Children with acutely active rheumatic fever were found to excrete more vitamin C than convalescent patients and retention improved with convalescence in this group. Sodium salicylate and sodium bicarbonate administrations increased excretion. Artificial fever induced by typhoid vaccine also caused a slight increase in elimination. No direct evidence was found to support the theory that rheumatic fever is a manifestation of a vitamin C deficiency associated with the infection, which has been accepted from work by other authors.—*Arch. Dis. Childhood*, 13:125, 1938.

Virgil D. Cheyne.

Diet in Relation to the Teeth

By Evelyn Sprawson

A summary is made of the known facts in our present knowledge of dental caries. It is admitted that comparatively little has been proved as to the relation of diet to caries. In consideration of the site of attack, the enamel, even less is known of the actual process. Calcification, histologic study, prism structure, the effect of sugars, bacterial fermentation, vitamins C and D, saliva composition, effect of fruit and psychologic influences are all considered and the attending little known facts pointed out.—*Brit. D. J.*, 64:245, 1938.

Virgil D. Cheyne.

Health Education and the School Child

By A. W. S. Thompson

The method of teaching the much-neg-

lected phase of "health education" is explained as it functions in Leicestershire and a method of correction for the deficiency as it exists in the general education system is proposed. It is held that promotion of health should be a prior consideration and other subjects should be fitted into the curriculum. Cleanliness, diet, clothing, matters of sex and the general rules of health should all be considered of major importance. The principles presented might well be heeded by the school system as it exists in this country.—*M. Officer*, 59:119, 1938.

VIRGIL D. CHEYNE.

Complex Type of Odontome

By F. C. WILKINSON

A BOY, aged 9, presented himself at the clinic with a non-inflammatory type of swelling in the region of the angle of the right mandible and a history of swelling for six months. Roentgenograms revealed a large cavity in this region, with the greater part of the developing second molar outside. On excision, the center of the cavity was of dense calcareous material and surrounded by a fibrous capsule. Histologically, the mass was irregularly arranged dental tissue consisting of enamel, dentin and pulp tissue. The author believes that the calcified mass developed from the part of the tooth germ which would normally have produced the crown.—*Brit. D. J.*, 65:99, July 15, 1938.

L. H. GARRISON.

Human Proportions

By LILIAN LINDSAY

THE author discusses the importance of proportions in orthodontics. She cites the work of Albrecht Durer, 1528, painter, draughtsman and sculptor, and compares his brilliant sense of observation and appreciation of proportion to that of Leonardo da Vinci. This artist, by years of study, developed principles which are used in orthodontics of the present day. Because he was unable ever to find the perfect man, he said: ". . . perfection of form and beauty is to be found in the sum of all men."—*D. Rec.*, 58:289, June 1938.

B. J. FREY.

Impacted Mandibular Third Molar

By C. B. HENRY

THAT the third molar teeth are not in the process of disappearance is stated by the author in his study of early Egyptian specimens and skiagrams of living persons. He further states that when the maxillary third molar is diminished in size, the mandibular molar is generally normal, but is impacted because of the lack of forward growth of both jaws. The treatment advocated for impaction of the third molar is enucleation of the developing tooth as early as possible. —*D. Rec.*, 58:321, June 1938.

B. J. FREY.

Vitamins and Hormones

By J. R. MURLIN

AFTER a good descriptive history of vitamins and hormones, the author further explains the action and function of these as regulatory substances and their relationship to each other from his own observations and that of others.—*J. Am. Diet. A.*, 14:397, 1938.

B. J. FREY.

Methods of Applying Radium Element in the Form of Needles and Tubes

By G. C. WILKINS

THE author, with clear illustrations, explains concisely the methods of applying radium to growths and lesions of oral nature. He stated that the simplest technical method which is efficient for the given purpose is usually the best.—*Am. J. Roentgenol. & Rad. Therap.*, 39:816, May 1938.

B. J. FREY.

Dental Caries in Lewis and Parts of West Ross-Shire

By J. D. KING

To determine the incidence of dental caries in relation to diet and dental hypoplasia, children of the Island of Lewis and the adjacent mainland country Ross-Shire were examined by means of mouth mirror and probe. Of the children examined, 1,030 were from country schools in Lewis, 250 from the town school of Lewis and ninety-six from Ross-Shire country schools. The caries incidence in various age groups is tabulated. Following is a summary for all ages up to the age of 15: In Lewis country, 14.0 per cent of all teeth were carious, 24.2 per cent of the deciduous and 7.9 of the permanent. In

urban Lewis, the percentages were 33.0, 52.2 and 19.6, respectively; in Ross-Shire, 34.7, 53.3 and 20.9, respectively. In country districts, 28.1 per cent of the children were free of caries; in the town, 2.0 per cent, and on the mainland, 6.3 per cent. A tabulation shows that only 1.3 per cent of hypoplasia-free teeth were carious, whereas 25.4, 70.3 and 92.3 per cent of teeth showing, respectively, grade I, II and III hypoplasia were carious. Three of the eleven grossly hypoplastic teeth found were carious.—*Lancet*, 235:109, 1938.

B. G. Bibby.

Erosions of the Oral Mucosa and Urticaria of the Body Following Small Doses of Sulfanilamide

By Maurice Henry Noun

A case history is given of a woman with suspected ethmoiditis. No blood abnormality was detectable on examination. The Kahn test was negative. An ephedrine preparation was tried with no noticeable improvement after seven days. These drugs were discontinued and 5 grains of sulfanilamide was given daily. Again no improvement was noted and the daily dose was doubled (10 grains).

Five days later, a generalized urticaria developed, followed by nausea and diarrhea. The next day, scattered mouth lesions the size of a pea were present with defined edges and a central reddish gray exudate.

Bacteriologically, no Vincent's infection was found. The blood count was normal. The sulfanilamide was discontinued and an alkaline mouthwash prescribed. Within seven days, the mouth lesions had disappeared. The mouth erosions persisted for twelve days.—*Arch. Derm. & Syph;* 6:1044-1045, June 1938.

Frank Allen.

Practical Stain for the Spirochetes of Syphilis and Vincent's Angina

By H. D. Bailey

A simple, rapid and reliable method for staining *Treponema pallidum* and *Borrelia vincenti* is described. The procedure is essentially as follows: 1. By means of a small loop full of water, spread the material to be examined on a clean slide which has previously been dried with air and fixed with heat.

2. Cover with N/20 hydrochloric acid and leave for ten seconds and wash in running water for five seconds.

3. Cover with Gram's iodine solution, leave from five to ten seconds and wash.

4. Cover with aniline gentian violet, leave from five to ten seconds and wash.

5. Cover with Gram's iodine solution, leave from five to ten seconds and wash.

6. Cover with aniline gentian violet, leave from five to ten seconds and wash.

7. Blot and examine slide.—*J. Lab. & Clin. Med.*, 23:960, June 1938.

Joseph F. Volker.

Microscopic Study of the Surface Enamel of Human Teeth

By M. J. Eisenberg

Examinations of cleaned enamel surfaces were made with reflected light at magnifications of from 50 to 750. Enamel rod ends showed more or less hexagonal or distorted semilunar outlines; that is, with five or six sides. Over the widest diameter of the tooth, and on small cuspal prominences of the palatal surfaces of incisors and cuspids, rods may be exposed and lie lengthwise for small distances.—*Anat. Rec.*, 71:221, June 1938.

Grant Van Huysen.

Etiology of Dental Caries: Further Investigations Regarding the Self-Proteolysis of Saliva

By J. Weinmann

A parallel exists between the extent of self-proteolysis of saliva and dental caries. The activity is greater in the caries-immune than in the caries-susceptible. The proteolysis was measured by determining the amino-acid increase, the ammonia increase and the rest-nitrogen increase in the saliva after twenty-four hours' incubation.

The presence of bacteria affects the rate of proteolysis and their action is not entirely inhibited by toluene. A mixture of toluene and choloform added to the saliva during incubation inhibits bacterial proteolysis, but not the enzymatic activity of saliva.—*Ztschr. f. Stomatol.*, 36:95, January 1938.

Martin Deakins.

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AMERICAN FOUNDATION: American medicine. 2 vols. New York: American Foundation, 1937. $3.50.

AMERICAN MEDICAL ASSN., BUR. OF MED. ECON.: Group hospitalization. Chicago: Amer. Medical Assn., 1937. $.75.

BAILEY, HAMILTON: Clinical surgery for dental practitioners. London: Lewis, 1937. $4.00.

BARNHILL, J. F.: Surgical anatomy of the head and neck. Baltimore: Wm. Wood, 1937. $20.00.

BIRCH, C. L.: Hemophilia—clinical and genetic aspects. Urbana, Ill.: Univ. of Illinois, 1937. $2.00 paper, $2.50 cloth.

BLACK, A. D.: G. V. Black's work on operative dentistry with which his special dental pathology is combined. 4 vols. V. 1—Pathology of hard tissues of teeth; oral diagnosis. V. 2—Technical procedures in making restorations in teeth. V. 3—Treatment of dental caries. V. 4—Diseases and treatment of investing tissues of teeth and other soft tissues of mouth. Chicago: Medico-Dental Publishing Co., 1936. Complete set $16.00, $4.50 per volume.

BLAIR, V. P., & IVY, R. H.: Essentials of oral surgery. St. Louis: Mosby, 1936. $6.50.

BLAYNEY, J. R.: Dental pharmacology and therapeutics. St. Louis: Mosby, 1936. $4.00.

BOYD, J. D.: Nutrition of the infant and child. New York: Nat. Medical Book Co., 1937. $3.00.

BOYLE, H. H.: Principles and practice of applied dental aesthetics. London: Kimpton, 1936. $7.25.

BRODERICK, F. W.: Principles of dental medicine: the medical aspects of dental disease. St. Louis: Mosby, 1936. $7.50.

BULLEID, ARTHUR: Bacteriology for dental students. St. Louis: Mosby, 1938. $4.75.

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CAMPBELL, HARRY: What is wrong with the British diet? London: Wm. Heinemann, 1936. $3.00.

CARNEGIE, DALE: How to win friends and influence people. New York: Simon & Schuster, 1937. $1.96.

COMROE, B. I.; COLLINS, L. H., & CRANE, M. P.: Internal medicine in dental practice. Philadelphia: Lea & Febiger, 1938. $4.00.

COOK LABORATORIES: Manual of local anesthesia in general dentistry. New York: Cook Laboratories, Inc., 1936.

DARLINGTON, C. G.: Yearbook of dentistry, 1936. Chicago: Year Book Pub. Co., 1937. $3.00.

DARLINGTON, C. G.: Yearbook of dentistry, 1937. Chicago: Year Book Pub. Co., 1937. $3.00.

DAVIS, M. M.: Public medical services: Survey of tax-supported medical care in the United States. Chicago: Univ. of Chicago Press, 1937. $1.50.

DOUGLAS, P. H.: Social security in the United States. New York: McGraw, 1936. $3.50.

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DUNNING, W. B., & DAVENPORT, S. E.: Dictionary of dental science and art. Philadelphia: Blakiston, 1936. $6.50.

ENNIS, L. M.: Dental roentgenology. Philadelphia: Lea & Febiger, 1936. $6.50.

EPHRAIM, J. W.: Take care of yourself: a practical guide to health and beauty. New York: Simon & Schuster, 1937. $2.00.

EPSTEIN, ABRAHAM: Insecurity; a challenge to America. New York: Random House, 1936. $4.00.

ESSIG, N. S.: Prosthetic dentistry. Brooklyn: Dental Items Interest, 1937. $4.00.

FAIRBROTHER, R. W.: Text-book of medical bacteriology. St. Louis: Mosby, 1937. $4.50.

FALK, I. S.: Security against sickness. New York: Doubleday, Doran, 1936. $4.00.

FISH, E. W.: Principles of full denture prosthesis. London: Bale, 1937. $5.00.

FURNAS, C. C., & FURNAS, S. M.: Man, bread and destiny: the story of man's food. New York: Reynal & Hitchcock, 1937. $3.00.

GREENFIELD, A. L.: X-ray technic and interpretation of dental roentgenograms. Brooklyn: Dental Items Interest, 1936. $6.00.

HADEN, R. L.: Dental infection and systemic disease. Philadelphia: Lea & Febiger, 1936. $2.50.

HILDEBRAND, G. Y.: Studies in dental prosthetics. 2 vols. Stockholm, Sweden: Aktiebolaget Fahlcrantz' Boktryckeri, 1937.

HOGEBOOM, F. E.: Practical pedodontia or juvenile operative dentistry and public health dentistry. St. Louis: Mosby, 1938. $6.50.

IVY, R. H., & CURTIS, LAWRENCE: Fractures of the jaws. Philadelphia: Lea & Febiger, 1938. $4.50.

JOHNSON, C. N.: Operative dentistry. New York: Natl. Medical Book Co., 1938. $3.00.

JORDAN, E. O., & BURROWS, WILLIAM: Textbook of general bacteriology. Philadelphia: Saunders, 1938. $6.00.

KANTOR, J. L.: Synopsis of digestive diseases. St. Louis: Mosby, 1937. $3.50.

KEY, J. A., & CONWELL, H. E.: Management of fractures, dislocations, and sprains. St. Louis: Mosby, 1937. $12.50.

KRONFELD, RUDOLF: Dental histology and comparative dental anatomy. Philadelphia: Lea & Febiger, 1937. $3.75.

LAMB, RUTH DE F.: American chamber of horrors. New York: Farrar & Rinehart, 1936. $2.50.

LEVINSON, C. A.: Examining dentist in food hazard cases. Boston: Author, 1937. $2.00.

LUFKIN, A. W.: History of dentistry. Philadelphia: Lea & Febiger, 1938. $2.75.

MAINLAND, DONALD: Treatment of clinical and laboratory data. London: Oliver & Boyd, 1938. $3.00.

MANSFIELD, WILLIAM: Materia medica, toxicology and pharmacognosy. St. Louis: Mosby, 1937. $6.75.

MASON, E. G.: Why we do it. Elementary discussion of human conduct and related physiology. St. Louis: Mosby, 1937. $1.50.

MCBRIDE, W. C.: Juvenile dentistry. Philadelphia: Lea & Febiger, 1937. $6.00.

MCCLENDON, J. F., & PETTIBONE, C. J. V.: Physiological chemistry. St. Louis: Mosby, 1936. $3.50.

MCGEHEE, W. H. O.: Textbook of dental pharmacology, materia dentica and pharmaco-therapeutics. Philadelphia: Blakiston, 1936. $4.25.

MCGEHEE, W. H. O.: Textbook of operative dentistry. Philadelphia: Blakiston, 1936. $10.00.

MILBANK MEMORIAL FUND: Next steps in public health. New York: Milbank Memorial Fund, 1936.

MILLER, S. C.: Oral diagnosis and treatment planning. Philadelphia: Blakiston, 1936. $7.50.

MILLER, S. C.: Textbook of periodontia. Philadelphia: Blakiston, 1938. $8.00.

MILLIS, H. A.: Sickness and insurance: study of the sickness problem and health insurance. Chicago: Univ. of Chicago Press, 1937. $2.00.

MISSOURI STATE DENTAL ASSOCIATION: History of dentistry in Missouri. Fulton, Mo.: Ovid Bell Press, 1938. $6.00.

MITCHINER, P. H.; SHATTOCK, C. E.; SLESINGER, E. G., & WAKELEY, C. P. G.: Surgery for dental students. Baltimore: Wood, 1936. $4.75.

NOYES, F. B.; SCHOUR, ISAAC, & NOYES, H. J.: Textbook of dental histology and embryology including laboratory directions. Philadelphia: Lea & Febiger, 1938. $6.50.

PADGETT, E. C.: Surgical diseases of the mouth and jaws. Philadelphia: Saunders, 1938. $10.00.

PEARLMAN, L. M.: Your breath and your health. 295 Madison Avenue, New York: Academy Pub. Co., 1936. $1.00.

PRINZ, HERMANN: Dental formulary. Philadelphia: Lea & Febiger, 1936. $3.50.

PRINZ, HERMANN: Diseases of soft structures of the teeth and their treatment. Philadelphia: Lea & Febiger, 1937. $6.50.

RAUGH, A. W.: Analgesia: nitrous oxide in dentistry. Newark, N. J.: Author, 1936. $3.50.

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in social security. New York: Harper, 1937. $3.00.

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RICE, T. B.: Textbook of bacteriology. Philadelphia: Saunders, 1938. $5.00.

SALZMANN, J. A.: Principles and practice of public health dentistry. Boston: Stratford, 1937. $4.00.

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TURNER, C. E.: Personal hygiene. St. Louis: Mosby, 1937. $2.25.

UNITED STATES PUBLIC HEALTH SERVICE: Dental survey of school children, ages 6-14 years, etc. Public Health Bull. No. 226. Washington, D. C.: Government Printing Office, 1936. 20c.

UNITED STATES PUBLIC HEALTH SERVICE: Survey of dental activities of state departments and institutions of the United States. Public Health Bull. No. 227. Washington, D. C.: Government Printing Office, 1936. 20c.

WALD, S. S.: Manual of dental roentgenology. New York: Guggenheim Dental Clinic, 1936. $2.25.

WELLINGS, A. W.: Practical microscopy of the teeth and associated parts. London: Bale, 1938. $4.00.

WHITE, E. GRACE: Textbook of general biology. St. Louis: Mosby, 1937. $3.00.

WHITEFORD, G. H., & COFFIN, R. G.: Essentials of college chemistry. St. Louis: Mosby, 1937. $4.00.

WIDDOWSON, T. W.: Dental surgery and pathology. London: Bale, 1937. $9.50.

WILLIAMS, H. E.: Scrapbook of dental informalities. Red Bank, N. J.: Author, 1938. $3.00.

WILLMAN, W. P.: Periodontia. New York: Natl. Medical Book Co., 1938. $3.00.

WILSON, NETTA W.: Alfred Owre. Minneapolis: Univ. of Minnesota Press, 1937. $4.00.

WILTON, AKE: Tissue reactions in bone and dentine. London: Kimpton, 1937. $4.50.

WINTER, LEO: Textbook of exodontia: exodontia, oral surgery and anesthesia. St. Louis: Mosby, 1937. $10.00.

YOUNG, M.; JOHNSON, E.; SMYTH, C., & STILL, M.: Investigations into the nature and characteristic features of post-normal occlusion. London: His Majesty's Stationery Office, 1937. $1.25.

ZAHORSKY, JOHN: Synopsis of pediatrics. St. Louis: Mosby, 1937. $4.00.

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ANNOUNCEMENTS

ANNOUNCEMENTS must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

CALENDAR OF MEETINGS

American Dental Association, St. Louis, Mo., October 24-28.

American Academy of Restorative Dentistry, St. Louis, Mo., October 22-23.

American Society for the Advancement of General Anesthesia in Dentistry, New York City, fourth Monday in March and October.

American Society of Oral Surgeons and Exodontists, St. Louis, Mo., October 21-22.

American Association of Public Health Dentists, St. Louis, Mo., October 23-24.

American Society for the Promotion of Dentistry for Children, St. Louis, Mo., October 24.

American Academy of Periodontology, St. Louis, Mo., October 20-22.

Association of American Women Dentists, St. Louis, Mo., October 24-28.

Great Lakes Association of Orthodontists, Cleveland, Ohio, November 7-8.

Greater New York Dental Meeting, New York City, December 5-9.

National Board of Dental Examiners, December 2-3.

Northern Illinois Dental Society, Freeport, September 28-29.

Greater Philadelphia Annual Meeting, February 1-3, 1939.

District of Columbia Dental Society, second and fourth Tuesdays in each month from October to June, at the United States Public Health Service Auditorium, Washington.

Pan American Odontological Association, St. Louis, Mo., October 24.

Marquette University Dental Alumni Association, Milwaukee, Wis., November 11-12.

Montreal Dental Club Clinic at Montreal, Canada, October 12-14.

American Dental Hygienists' Association, St. Louis, Mo., October 24-28.

American Dental Assistants Association, St. Louis, Mo., October 24-28.

STATE SOCIETIES

September

Southern California, at Coronado Beach (12-14)

November

Ohio, at Cleveland

Florida, at Jacksonville (10-12)

STATE BOARDS OF DENTAL EXAMINERS

Indiana, at Indianapolis, November 14. J. M. Hale, Mt. Vernon, Secretary.

New Jersey, December 5-10. Walter A. Wilson, 148 W. State St., Trenton, Secretary.

New York, September 19-22. Minor J. Terry, Education Bldg., Albany, Secretary.

Texas, at Dallas, November 14-17. B. Carl Holder, 1009 Nixon Bldg., Corpus Christi, Secretary.

Wisconsin, at Milwaukee, December 12-16. S. F. Donovan, Tomah, Secretary.

NATIONAL BOARD OF DENTAL EXAMINERS

The National Board of Dental Examiners will hold a meeting for the examination of candidates in Parts I and II, December 2-3, in cities where five or more candidates present themselves for examination. For information and application blanks, address

MORTON J. LOEB, *Secretary,*
66 Trumbull St.,
New Haven, Conn.

TEXAS BOARD OF DENTAL EXAMINERS

The Texas Board of Dental Examiners will hold its next examination November 14-17, at the Adolphus Hotel, Dallas. Applications must be filed at least ten days prior to the date of the examination. For further information, address

B. CARL HOLDER, *Secretary,*
1009 Nixon Bldg.,
Corpus Christi.

INDIANA STATE BOARD OF DENTAL EXAMINERS

The next examination for licensure of the Indiana State Board of Dental Examiners will be held in Indianapolis beginning November 14. All applications, fees and credentials must be in the hands of the secretary not later than ten days before the beginning date of the examinations. For appli-

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J. M. HALE, *Secretary,*
Mt. Vernon.

WISCONSIN STATE BOARD OF DENTAL EXAMINERS

The next examination of the Wisconsin State Board of Dental Examiners will be held at the school of dentistry, Marquette University, Milwaukee, December 12-16. Applications and the required fee must be in the hands of the secretary not later than December 6.

S. F. DONOVAN, *Secretary,*
Tomah.

REUNION OF FORSYTH INTERNS

A reunion of all Forsyth interns who have graduated from the Forsyth Dental Infirmary for Children, Boston, interns' staffs 1915-1938, will be held at the Annual Session of the American Dental Association in St. Louis in October. The purpose of the reunion is to give honor to the founders of the Forsyth Dental Infirmary as well as its director, Percy R. Howe, and his staff. Mail reservations at once to Robert A. Harris, Jr., University Club Building, St. Louis, Mo.

MARQUETTE UNIVERSITY DENTAL ALUMNI ASSOCIATION

The Thirty-Second Annual Meeting of the Marquette University Dental Alumni Association will be held in Milwaukee, November 11-12.

WILLIAM VAN HORN,
Publicity Chairman,
3803 W. Center St.,
Milwaukee, Wis.

GREATER NEW YORK DENTAL MEETING

The Fourteenth Greater New York Dental Meeting will be held December 5-9 at the Hotel Pennsylvania, New York City.

GEORGE C. DOUGLASS,
Room 106A,
Hotel Pennsylvania,
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No. 2,119,579, to HARRY C. HAGMAN and ALEXANDER S. T. LAGAARD. Dental articulator.

No. 2,119,823, to JAMES S. MILLER and CARL RICHARD WALLER. Method and means for use of articulator in dentistry.

No. 2,119,824, to JAMES S. MILLER and CARL RICHARD WALLER. Apparatus and process for use of articulator in dentistry.

No. 2,119,896, to WILLIAM E. VAN DORN and WILFRED H. TERRELL. Articulator.

No. 2,119,908, to JOSEPH ELLIS. Wax modeling spatula for dental work.

No. 2,119,912, to JULIUS D. FUSELIER. Tongue depressor dispenser.

No. 2,119,920, to HERBERT KÖNIGSMANN. Flask for dental purposes.

No. 2,120,091, to ULYSSES G. DENSTEN. Fogless mirror for dental and like uses.

June 14

No. 2,120,604, to CHARLES WILLIAM FAIN. Toothbrush.

No. 2,120,827, to ERICH H. ZAHN. Denture mounting.

June 21

No. 2,121,047, to COLBERT C. POPE and HENRY T. SLATON. Tooth powder dispenser.

No. 2,121,196, to JAY A. HEIDBRINK. Anesthetizing apparatus.

No. 2,121, 358, to ALBERT LOEFFLER. Toothbrush.

No. 2,121,373, to WILLIAM E. D. TURNER. Toothbrush.

No. 2,121,701, to JOHN LANDERS. Dental cleaning and massage device.

June 28

No. 2,122,011, to FRIEDRICH SCHOENBECK. Dental filling composition.

No. 2,122,101, to ALBERT LANGE. Dental tray.

No. 2,122,213, to ALFRED J. OLIVER. Orthodontic model former.

No. D-110,274, to HENRY DREYFUSS. Dental equipment stand.

No. D-110,275, to HENRY DREYFUSS. Dental equipment stand.

No. D-110,276, to HENRY DREYFUSS. Dental equipment unit.

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